

B20-64

\$10.00

THE
SCHOOL VISITOR,
DEVOTED TO
MATHEMATICS, ENG. GRAMMAR,
EXAMINATION QUESTIONS,
NOTES, QUERIES AND ANSWERS.

JOHN S. ROYER, Editor & Publisher.

VOLUME VI.

Printed by the Editor.
1885.

INDEX TO VOLUME VI.

- | | | | | | |
|--------------------------------|-----------|------------------------------|------|-----------------------|-----------------|
| Abelard, | 194. | The republic has no | 149. | Botany, father of | 42. |
| Abridged sentence, | 162. | Choose, each man | 171. | Brick, weight | 146. |
| Adams, Pres. | 169, 216. | <i>Wonders of Invisible</i> | 172. | Bridge of boats, | 43. |
| Advice to teachers, | 237. | The worst men | 173. | over Nile, | 129. |
| Air-bladder, fish, | 110. | Fortune like the | 192. | British lion, | 197. |
| Akers, Elizabeth | 193. | Young man, your | 192. | Brunette & Blonde, | 217. |
| Aladdin's window | 245. | <i>Rock Me to Sleep,</i> | 193. | Bryant, | 171. |
| Alaska, | 165. | <i>Curfew must not</i> | 217. | Bulgaria, | 66. |
| Aliminos, | 110. | Am I on a bed of | 218. | Bumblebee, clover, | 219. |
| Allen, William | 89. | <i>Bat'le Cry of Fre'dom</i> | 243 | Bunyan, John | 93. |
| Almanac, | 150. | The unfinish'd win- | 245. | Burke, | 42. |
| Alphabet, | 163. | Babel Mandeb, | 147. | Burroughs, exe'ted | 130. |
| Amazon, why named | 69. | Balboa, | 171. | Byron, death of | 130. |
| Ambrose, | 197. | Baths, mud. | 247. | Cabinet officers, | 13. |
| Ameer of Afghan, | 246. | Barbers pole, | 20. | dissolved, | 130. |
| Analysis, higher | 173. | Barn burners, | 40. | Caldwell, Jas. | 111. |
| Andorra, republic | 46. | Bates, George | 130. | California, how got | 165. |
| Animal, pliocene | 242. | Battle So. Mills, | 94. | Canal, Erie | 125. |
| Annexation bill, | 169. | Spurs, | 193. | isthmus Pan., | 70. |
| Anti-renters, | 40. | Brothers, | 193. | Candidates, advice to | 127. |
| Ants, history of | 196. | Lake Erie, | 87. | Canada, provinces | 166. |
| Arsenic eaters, | 132. | Baxter, Richard | 41. | Canute, | 42. |
| Astronomy, history | 170. | Bayard of South, | 44. | Carnelly, Thos. | 220. |
| Atlantis theory, | 133. | Bede, venerable | 131. | Caroline books, | 168. |
| Athens, | 69. | Bill of Attainder, | 90. | Carrollton, Chas. | 169. |
| Australia, zones, | 86. | Biography of contr's, | 231. | Carties & Cortes, | 165. |
| Austrians defeated, | 130. | Blair, Francis | 148. | Cat, Whittington's | 71. |
| Author of | | Blessing of bay. | 169. | Cats & dogs, rain | 247. |
| How small of all, | 22. | Blockad' of Belparts, | 130. | Celcius, a Swede, | 40. |
| <i>Saints Everlast'g R'st,</i> | 41. | Blue Stocking, | 246. | Center of population, | 66. |
| He who brings me, | 42. | Boards, edges turn | 170. | of gravity, | 148. |
| Thirty days hath, | 68. | Book Fish, | 244. | Centennial planned, | 147. |
| Theory of Limits, | 68. | Notie's 26 96 136 | 176. | Champlain, | 68, 165. |
| <i>Home, Sweet Home,</i> | 132. | Boston port bill, | 188. | Charles, | 192-4, 94, 243. |
| Good faith, if | 146. | nickname, | 40. | Chautauqua lake, | 106. |
| With Devotions vis- | 146. | Boulders, how came | 242. | Checkers, game of | 146. |

IV.

INDEX TO VOLUME IV.

Chief justices,	62.	Discoveries,	239	Game Cock,	44.
Christina, queen	130.	Dorr's Rebellion,	165.	Garden City	40.
Charlemagne,	168.	Dred-Scott decision	61.	Garfield boys,	130.
Charleston founded,	168.	Duche, Rev. Mr.	90.	Gas,	21.
Chautauqua	106.	Dndley, Sir Robt.	197.	Gate of Tears,	147.
Cincinnati, site	217.	Duel fought,	165.	General blown up,	91.
Circulates,	22.	Dutch Governors,	125.	Geography, changes,	148.
Circular numbers,	68.	Earth's shad'w, length	45.	Georgia, settled	239.
City, highest,	171.	ecliptic obliq'ty,	70.	German states,	41.
violet crown,	69.	orbital motion,	132.	Geysers,	187.
notions,	40.	orbit an ellipse'	147.	Ghent, treaty	170.
nicknames,	43.	ages of	166.	Gorseng, prized	21.
largest,	238.	its diameter,	219.	Glass,	21.
Clay in succession,	131.	Earl of Essex	217.	Gold leaf,	41.
Coals to Newcastle,	92.	Easter, how found,	169.	Gold rule, arith.,	108.
College, Trinity	41.	Eclipse, solar, 481	130.	Gorboduc,	130.
oldest in U. S.,	87.	Editorial Notes,—15, 35,		Governor, Texas	189.
Colonial governm's,	39.	63, 84, 122, 145, 166.		salary,	69.
Columbus, voyages,	215.	Edward IV. of Eng.,	194.	Gray's Elegy,	210.
Convention, dem.	169.	Electors, 1824,	39.	Great Unwashed,	42.
Congressmen, Ohio	68.	Elizabeth's affection,	217.	Gregory of Sours,	43.
Congress, called sess.,	67.	Elm City,	40.	pope,	221.
chaplain,	90.	Emancipation,	87.	Guatemala,	87.
48th	39.	Engine, fire	21.	Gulf Stream,	110.
Conway Cabal,	20.	Engraving,	21.	Guns, invention,	220.
Cook, Capt.	148.	English statesman,	91.	Hague, the	192-8.
Copal, gum	92.	Eng. Grammar,	104.	Hamlin, Helen	217.
Cornwallis, surrender	19.	Eng. settlement	187.	Hampden, John	130.
Corn mixing,	220.	Equator, not circle,	223.	Happy old couple,	172.
Cotton refuse,	247.	Erie Canal,	169.	Hasbrouch House,	92.
Council of Pisa,	221.	Ettrick Shepherd,	69.	Hatton, bishop	42.
Country schools,	237.	European explorers,	38.	Helen, Longfellow's	217.
Crazy queen,	67.	Ensebius,	197.	Henry II., France,	192.
Crown Point,	69.	Events, July 3, 4, 1863,	87.	VI., England,	194.
Curfew law,	197.	most import't,	106.	VI., humbled,	221.
Cutler, Dr.	223.	on July 4th,	169.	Herat,	87.
Cylindrical sun,	146.	Everglades,	187.	Hints to teachers,	123.
Darby,	172.	Examiner's law,	127.	History 19,	214.
Darwin, Dr. Chas.	130.	Examination questions		Hobson's choice,	149.
Dating, A. D.,	218.	16-19, 3639, 60-2, 86-8,		Hogg, James	69.
Davis, capture of	220.	105-7, 124-6, 143-5,		Holland, friendly	94.
Davy, Humphrey	172.	162-6, 184-8, 211-5, 238.		Holmes, Dr.	171.
Day of Herrings,	194.	Expost facto Law,	90.	Hong Kong,	106.
Death of Presidents,	39.	Fahrenheit,	40.	Horses, prehistoric	46.
Decius, emperor	43.	Fernel,	219.	Horse shoe, luck,	147.
Dec. of Independ'nce,	19.	Feudal system,	20.	Hueppe, Dr.	45.
Decoration Day,	174.	Fire flies & army,	197.	Hunkers,	45.
Demosthenes, English	42.	Fish, raining,	243.	Hurrah,	149.
Democracy,	42.	Flag, U. S.,	92, 104.	Ice, wonders,	195.
DeSoto,	165.	Florida,	165.	Icebergs,	238.
Diagrams of sentenc's,		Flowers, botany,	219.	Id., meaning,	42.
12 17, 39, 62, 85, 88, 107,		Foolscap,	149.	Iguala, plan of	133.
126, 128, 163-7-8, 190-1.		France, friendly	125.	Impeachment, Pres.	61.
Diam'ds, U. S. Tres.,	148.	Francis I.,	194.	Inch, comparative	129.
Dipping needle,	22.	Franklin's kite,	174.	India rubber,	149.
Discoveries of		Free soilers,	40.	Indians,	19, 87, 125.
Labrad'r, Cuba, Hud-		French explorations,	68.	Indiana Ter.,	19.
son Bay, the St. Law-		Fugitive slave law,	61.	Infinitives,	65.
rence river, Pacific,	125	Gadsden purchase,	215.	Inspired Tinker,	93.
D'Israeli,	130.	Galvanism,	28.	Inventions,	30, 215.

Iron man,	132.	Marion, Gen.	44.	Decagon, inscrib'd	102.
Pen,	217.	Mason & Dixon line,	188.	Diaphantine,	115, 182,
Isoclinal lin's, etc.	69, 166.	Mather, Cotton	172.		225-8.
Iturbide, Augustine	133.	Matches,	21.	Digging potatoes,	113.
Jablochhoff,	172.	May fly, June bug,	246.	Dodecagon, inscrib'd	102.
Jamestown Ford,	169.	Mausoleum of hearts,	69.	Dome, tin on	79.
Jefferson,	42, 61, 169.	Mecklenberg res.,	165.	Field & fence,	75, 201.
Jetty system,	71.	Melancthon, death	130.	Garden, spring	98.
Joan of Arc,	172.	Memnon, statue	150.	walk,	73, 97.
John the Good,	146.	Mermaids,	192.	filling up,	7.
Joule, Dr.	195.	Mesmerism,	218.	Groins,	73.
Justian Martyr,	197.	Michael, Louise	111.	Hogs to market,	119.
Kabul,	106.	Microbe,	42.	Horse grazing,	2, 4.
Kansas-Nebr'ska bill	215.	Microscope,	21.	Indeterminate,	119, 182.
Kelat,	206.	Mile, comparative	218.	If 7 is $\frac{1}{2}$ of 20,	201.
Kendall, Amos	148.	Milky way,	41.	Kettles, two	6.
Khartum,	87.	Miss. Scheme,	125.	Ladder, sliding	100.
Kitchen Cabinet,	148.	Missouri Comp.,	19, 215.	Locus of point,	155.
Know Nothings,	40.	Mob, Anti-abolition,	169.	Log squared,	78.
Kossuth, Lewis	111.	Montcalm,	165.	Monograms,	10, 58.
Kotszta affair,	89.	Monroe,	169, 189.	Numbers, perfect	28.
Ladies Peace,	194.	Montezuma,	218.	prime,	52.
Language, our	106.	Montenegro,	46, 66.	Oak, strength	49.
Las Casas,	245.	Monsoons,	187.	Paraboloid,	180.
Latimer, Geo.	89.	Moon rising later,	150.	Partnership,	3, 30, 56.
Lavoisier, physicist	149.	Mormons,	125, 238.	Pasture,	99.
Laws, Alien, etc.,	87.	Morse, Prof.	131.	Pendulum,	157.
Lawrence, Jas.	106.	Mound, serpent	242.	Percentage, 6, 52, 98-9,	
Lead, struck,	194.	Mouse tower,	42.	115-6-7, 155-7, 177, 181,	
League, a	94.	Mountain, boiling	197.	202-3-4-5-8.	
Leggett,	70.	Mrs. pronounced,	42.	Pipes, cistern	99, 203.
Leosthenes,	192.	Mt. Vernon,	133.	π circulate?	120.
Liberia,	46.	Mugwump, origin	151.	Poles, breaking	29.
Library of Paris,	194.	Mutiny Act,	188.	Power of 14,	177.
License to teach,	93.	Mathematics,		Prism in water,	207.
Liddell, Dean	129.	Algebra, 5, 7, 32, 53-5,		Probability,	74.
Light, Electric	21, 172.	76, 140, 153.		Progression,	119.
velocity of	45.	Alligation,	26.	Proportion,	100.
Lightning,	247.	Army, square	77, 237.	Pyramid,	203.
Lincoln, Gen.	20.	Balls,	9, 75, 101, 158.	Quadrant, divide	156.
funeral,	94.	Belt on pulleys,	58.	Race bet. posts,	51.
Linnæous, swede,	42.	Board, tapering	205.	Random, stick	181.
Little Rock,	69.	Body, moving	228, 230.	Roof $\frac{1}{2}$ pitch,	6.
Locksley Hall,	171.	Bowl, hemispherical,	159.	Room, floor	56.
Locke, John	150.	Candle,	8, 55.	Section lines, travel	137.
Locomotive,	21.	Carpet,	208, 227.	Semi-circle, divide	138-9.
Log Cabin Cand.,	221.	Center of gravity,	141.	Shadow of stick	27.
Longfellow,	171, 245.	Chance,	8.	elliptical,	25.
Lost child,	243.	Circle, concentric	6.	Shore, trend	33.
Louisiana, buy,	165, 217.	Davison,	80.	Shooting bird,	54-5.
Louis XI., France,	194.	ratio,	1.	Slab, solidity	57.
XII.,	193.	Clock,	140, 184, 206.	Sound of shell,	137.
Good natured,	193.	Cloth, shrinking	180.	Specific gravity	114, 27.
Lowell, J. R.	71.	Conic cistern,	179.	Spectacles, focal	29.
Mackey, Chas.	243.	Conical cork,	207.	Sphere,	27, 178, 226.
Magnetic Observat'y,	170.	Courier & Army	31.	Spiral tube,	56.
meridian,	147, 216.	Cube, diag.	138, 154.	Square field, rood	117.
Man in Iron Mask,	44.	Cups, silver	158.	stone, solidity	226.
Manitoba,	87.	Curve of pursuit,	32.	Sun, altitude	1, 230.
Mary, queen	132.	Cylinder,	206.	Towers, two	154.

- Travelers, 50, 101, 114.
 Trees in 5 rows 116, 138.
 Triangle, 7, 26, 51, 77,
 101, 103, 104, 118, 155,
 229.
 Nameless City, 41.
 Neptune, 45.
 New Haven, 41.
 Newman, John 44.
 Noted events, Apr. 19,
 94, 130.
 Observatory, U. S. 150.
 Ocean, color of 219.
 current, 238.
 boundaries, 151.
 Oedipus, 150.
 Officer killed, 110.
 O'Hara, Gen. 172.
 Ohio, admitted 214.
 Oklahoma, 106.
 Old Prob. 133.
 Opium district, 22.
 Ordinance 1787, 223.
 Organs of speech, 163.
 Orphan Asylum, 1st 89.
 Oxford college 129.
 Panama Canal, 174.
 Papal see, 221.
 Parishes, why cal'd 90.
 Participles, 64.
 Patroons, 39.
 Patagonia, 69.
 Paul Revere. light for 44.
 Payne, John Howard 132.
 Peacemakers, 111.
 Penjdeh, 106.
 Persons, why vicious 71.
 Pepsin and milk, 45.
 Philip the Fair, 193.
 Phocion, 192.
 Phoenix, legends 246.
 Piano-forte 21.
 Pichincha, volcano 197.
 Pied piper, 43.
 Pierce, Franklin 44, 69.
 Pike, Gen. 91.
 Pitch Lake, 198.
 Pitt, William 66.
 Pizarro, 165, 171.
 Plateaus, 86.
 Platinum wire, 41.
 Planet, last disc'd 43.
 Plato, legend 47.
 Plymouth Rock, 221.
 Political parties. 189.
 Ponce de Leon, 165.
 Pons Asinorum, 68.
 Postoffices, first 147.
 Popes, 198, 245.
 Potosi, 171.
 Portland fire, 169.
 Presid'nts, 22, 61, 131, 165.
 Priapus Phallus, 147.
 Printers square, 151.
 Dr. Price, 130.
 Prichard, Col. 220.
 Providence, R. I. 169.
 Puff Ball, 92.
 Pulling, John 44.
 Puzzle, Christ'n & T. 220.
 Race course, lay off 146.
 Rahl, Col. 70, 110.
 Railroad, 1st in U. S., 19.
 Rat of fable, 42.
 Religion, 39, 165.
 Revolution, end of 94.
 Rhode Island, cap. 173.
 Riddle of Sphinx, 150.
 Rides, famous 92.
 Ring, allusions 245.
 Riot, dead rabbit 169.
 Rivers, use of 213.
 Robin, legends 90.
 Roemer, 45.
 Rome, ancient 41.
 Roof of World, lake 21.
 Room, noted 92.
 Ross, 22, 92.
 Rule to find day, 93.
 Rush, Benj. 130.
 Roumania, 66.
 Sandwich Islands, 148.
 Sackville. death 130.
 San Marino, 46.
 San Salvador 91.
 Santa Anna, 131.
 Saunderson, Math. 130.
 School discipline, 18.
 Schism of West, 221.
 Scourge of ocean, 148.
 Sciota sunk, 169.
 Sea cows, 192.
 cucumbers, 244.
 movements, 166.
 Seal of U. S., 169.
 Seceded states, 62.
 Secret society, 150.
 Sedillet, Chas. 42.
 Senators, 62, 132, 165.
 Servia. ruler 66.
 Seven Sleepers, 43.
 Shays Rebellion, 20, 165.
 Shadow, your 247.
 Shepherd, Gen. 20.
 Shipton, Mother 243.
 Sicilian vespers, 94.
 Sick man, Europe 133.
 Siena's Saint, 67.
 Silver Gray, 40.
 Silver spoon, 247.
 Silent Sisters, the 41.
 Sirikol, lake 21.
 Skeleton in closet, 172.
 Skedaddle, 173.
 Sky, color of 219.
 Slavery, 19, 61, 174.
 Sleepless chief, 133.
 Snow on Mts. 42.
 Somerset, James 89.
 South sea bubble, 243.
 Speaker of House, 172.
 Stamp, portraits 68.
 Act, 87, 188.
 Stark, Mollie(?) 242.
 Stanhope, Lady 67.
 Statue, singing 150.
 States rights, 19.
 St. Catherine, 67.
 St. Clair, Gen. 87, 223.
 Stonewall Jackson, 197.
 Streaks in ceiling, 134.
 Sumpter, Gen. 44.
 Sunday School, 1st 247.
 Sun spots 130, 170.
 Swamp Fox, 44.
 Angel, 91.
 Sword of Cornwall's, 172.
 Switzerland, 245.
 Synod of Edinburg, 130.
 Taylor, John 93.
 Tell & Gessler, 245.
 Telegram, 91.
 Telescope, largest 151.
 Tennyson, 171.
 Territory, N. W. 61.
 acquired, 19, 39.
 Thanksgiving, 196.
 Thermometer, 21, 40.
 Tides on Seas, 247.
 Tobacco, essay 244.
 onquin, 87.
 Tornado, 169.
 Torpedo, 21.
 Tower of London. 147.
 Jeffries, 130.
 Treaty of Paris, 66.
 Nicaragua, 70.
 Tripartite, 132.
 Merchants, 194.
 Cambrai, 195.
 Six of U. S, 239.
 Trees, historical 67.
 Trenton, battle of 70.
 Trinidad, wond'rs of 198.
 Triumvirate, 244.
 Tropics, why fixed 124.
 Tunnel. Hoosac 242.
 Turkish empire, 133.
 Turlutian, 197.
 Truce of God, 219.

University of Paris, 194.	Washington's maxims' 108.	Whisky Insurrection 125.
Valentia, 41.	monum't, 169-173	Whittier, 171.
Van Twiller, 108.	sustained 20.	Wilmot Proviso, 40, 165.
Venezuela revolut'n, 94.	Water Poet, 93.	Winthrop, Robt. 169.
Vera Cruz, meaning 91.	Watt's hymn books, 111.	<i>With & by</i> , uses of 47.
Victoria lake, 106.	Watches, inventor 21.	Woodfall, Henry 172.
Vicksburg, sur'dered 169.	Wayne, Anthony 133.	Wolfe, 165.
Voice, range of 197.	Webster's brain, 44.	Wonderful doctor, 221.
Wars & Treaties U. S. 39.	Webster, treaty 165.	Wooden Leg, 131.
Wars, cause of 165-6	Wedding anniversa's 168.	Woolly Heads 40.
War, Mexican 87.	Weight in vacuum 40.	Wyoming Valley, 169.
French & Indian 106.	West Indies, 86.	Yankee, origin 149.
of 1812, 106.	Whittington, Rich. 71.	Zones, Phys. & Math. 213.
Patriot, 125.	Whitefield, Geo. 89.	Zuyder Zee, founded 46.



EDITED BY

JOHN S. ROYER.

VOL. VI.

JANUARY, 1885.

No. 1.

✦ Practical Mathematics. ✦

SOLUTIONS OF PROBLEMS.

618. Prove by the method of limits that the circumferences of any two circles are to each other as their radii.

By MARCELLUS M. THOMPSON, *Clarksburg, W. Va.*

The best mathematicians insist that a variable never reaches its limit, consequently never substitute the former for the latter. Prof. Wood well says: "*that if two variables are always equal their limits are equal.*" Upon this proposition the solution of many intricate questions depends. We, therefore, give another solution of Prob. No. 618.

Represent the circumferences and radii of any two circles by C , C' and R , R' respectively. Inscribe two regular polygons in the two circles, "whose sides, always equal in number, are supposed to be doubled an indefinite number of times." In the language of Bledsoe of the University of Virginia: "the circumferences of the circles are then the limits of the peripheries of the polygons. But these peripheries are to each other as the radii of the circumscribed circles. Hence their limits, the circumferences, are in the same ratio to each other." That is, $C : C' :: R : R'$; or the circumferences of any two circles are to each other as their radii. [See p. 181, Vol. V.]

637. At what altitude will the rising sun be in the east point at the time of the summer solstice?

By S. G. CAGWIN, *New London, N. Y.*

Put $\delta = 23^\circ 27' 22\frac{1}{2}"$, the declination of the sun 1884, $\lambda = 40^\circ 42'$, latitude of New York City, and a = the required altitude. Then we have $\sin a = \sin \delta \div \sin \lambda = 37^\circ 37' 9.54"$, answer.

As the sun would be on the prime vertical at that time, it is solved by a right-angled spherical triangle, which is very simple.

I have taken the declination exact as it varies about half a second in a year. In 1885 it will be $23^{\circ} 27' 22''$, and in 1935 it will be $23^{\circ} 26' 57''$. I have a history of this as far back as the year 880.

By WILLIAM HOOVER, *Athens, Ohio.*

Let A = the azimuth of a heavenly body, and use the notation of the previous solution of this problem; then

$$\cot A = [\cot P \cos(y + \varphi)] \div \sin y.$$

But at sunrise, $A = 90^{\circ}$; $\therefore 0 = \cot P \cos(y + \varphi)$, whence $y = 90^{\circ} - \varphi$. But there was assumed $\tan y = \cos P \cot \delta$; $\therefore \cot \varphi = \cos P \cot \delta$, in which φ and P are unknown, so that the problem is indeterminate. If the time of sunrise at the date of the solstice was given the latitude could be found.

I carelessly solved the problem before as if "solstice" read equinox.

656. *By the EDITOR.*—A farmer tethers a horse to a flexible pole 12 ft. high. By pulling the rope, the horse bends the pole in the arc of a circle, bringing the top one-third lower to the ground, and is thus enabled to graze over half an acre on level ground. Required, the length of tether or rope.

By A. L. FOOTE, *Hempstead, Long Island.*

It will readily be seen that we have given the length of an arc (24) of a circle and the chord of the arc (16) to find the height or versed sine of the arc. Let x = height, then chord of half the arc

$$= \sqrt{x^2 + 64} \text{ and } \frac{1}{3}[8\sqrt{x^2 + 64} - 16] = 24,$$

from which we have $\sqrt{x^2 + 64} = 11$ and $x = 7.55$ ft. nearly. Now one half acre = 21780 sq. ft. and $\pi r^2 = 21780$ and $r = 83.263 +$ ft. and $83.263 - 7.55 = 75.713$, and finally we have

$$\sqrt{(75.713^2 + 8^2)} = 76.1345 + \text{feet, nearly.}$$

Solved by W. L. Harvey, A. F. Parsons, Henry Gunder and H. A. Wood.

657. *By the EDITOR.*—The front wheels of a carriage are 3 feet and the hind wheels four feet in diameter. The nearest distance between the fore and hind wheel is $1\frac{1}{2}$ feet, and the tracks 6 feet apart. If the carriage be turned so that the outside hind wheel tracks with inside fore-wheel, what is the diameter of the circle they will describe?

By HENRY GUNDER, *New Castle, Ind.*

Let R = radius of circle described by center of front axle. When the outside hind wheel tracks with the inside front wheel, a right-angled triangle is formed, and these relations hold:

$$R^2 = (R-6)^2 + 24\frac{3}{4} \dots (1),$$

where $24\frac{3}{4} (5^2 - (\frac{1}{2})^2)$ is the square of the distance between the front and the hind wheels, on the ground. From (1), $R = 5\frac{1}{6}$ feet, and $(5\frac{1}{6} - 3) \times 2 = 4\frac{1}{3}$ feet, diameter of required circle.

A. L. Foote solved it.

658. By H. LENICH MEYER, *Anneville, Pa.*—A and B own a farm with equal shares. The tenant pays \$45 rent. Their share of crops is \$395. The tenant expends \$31.95 on the farm which A and B pay out of their share. A expends nothing, B \$165.41. A has received \$22.50 and B \$280.55. What sum should A and B each receive on settlement?

By HARRY DERSHEM, *Gettysburg, Ohio.*

The gross receipts are $\$395 + \$45 = \$440$. The expenses are $\$31.95 + \$165.41 = \$197.36$. Balance to each one's credit $(\$440 - \$197.36) \div 2 = \$121.32$, of which A is entitled to $\$121.32 - \$22.50 = \$98.82$ and B $\$121.32 - (\$280.55 - \$165.41) = \6.18 , on settlement.

Solved by A. L. Foote, A. F. Parsons and J. C. Gregg.

659. By J. L. FELLER, *Mt. Olive, Va.*—A man has two watches, and a chain worth \$20; if he put the chain on the first watch it will be worth $\frac{2}{3}$ as much as the second watch, but if he put the chain on the second watch it will be worth $2\frac{3}{4}$ times the first watch; what is the value of each watch? Solve by Arithmetic.

By H. A. WOOD, *204 East 51st Street, New York.*

By the first condition $\frac{2}{3}$ the value of the second watch is \$20 more than the value of the first watch. Then the value of the second watch is $\frac{2}{3}$ that of the first, + \$30.

By the second condition the second watch is worth \$20 less than $1\frac{1}{4}$ of the first. We then have $1\frac{1}{4} - \frac{2}{3} = \frac{5}{12}$ of the value of the first watch = $\$30 + \$20 = \$50$. If $\frac{5}{12}$ of the value is \$50, the value is \$40, and $1\frac{1}{4}$ of \$40, $-\$20 = \90 , value of the second watch.

By J. C. GREGG, A. M., *Brazil, Ind.*

By the conditions of the problem the first + 20 = $\frac{2}{3}$ of second..(1),

$$1\frac{1}{4} \text{ of first} = \text{second} + \$20 \dots (2).$$

Adding (1) and (2) and subtracting \$20, $1\frac{1}{4}$ of first = $\frac{5}{3}$ of second or $\frac{3}{4}$ of first = $\frac{1}{3}$ of second..(3). Subtracting (1) from (2) we have $\frac{1}{4}$ of first $- 20 = \frac{1}{3}$ of second + 20..(4). From (3) $\frac{3}{4}$ of first + 20 = $\frac{1}{3}$ of second + 20..(5). Taking (5) from (4), first = 40; from (3), second = 90.

Also elegantly solved by Messrs. A. L. Foote, J. W. Watson and A. F. Parsons.

660. By LON. C. WALKER, *New Madison, O.*—A man owning two horses and a circular field containing 10 acres. He wishes to fasten them to a post with ropes so that one can graze over an acre outside of the field and the other to graze over an acre inside of the field. What length of rope is required for each horse?

By W. L. HARVEY, *Maxfield, Me.*

Let O be the center of the field and C the position of post to which the ropes attached to the horses are fastened, $OA=OC=R$ = radius of the field = 22.5674, $CA=CD=CE=r$; $\angle ACO=z$, then $\angle AOC = \pi - z$ and $\angle ACD = \pi - z$; $r = 2R \cos z$ because $R \cos z = \frac{1}{2} AC$.

They can graze outside the field the sector $ACBDA$ — segments m and n . The sector $ACBDA = r^2(\pi - z) = 4R^2(\pi - z)\cos^2 z \dots (1)$. The segment $m = \text{sector } AOC - \triangle AOC$. The sector $AOC = \frac{1}{2}R^2(\pi - 2z)$.

$$\triangle AOC = \frac{1}{2}R^2 \sin(\pi - 2z) = \frac{1}{2}R^2 \sin 2z.$$

$\therefore$ the segments m and $n = R^2(\pi - 2z) - R^2 \sin 2z \dots (2)$. Adding (1) and (2), $4R^2(\pi - z)\cos^2 z + R^2(\pi - 2z) - R^2 \sin 2z = 1 \div m(R^2\pi) \dots (3)$; $2\cos^2 z = \cos 2z + 1$ and this gives

$$z = \frac{\sin 2z}{2\cos 2z} + [(m-1)\pi \div 2m \cos 2z] + \pi$$

$$= \pi + \frac{1}{2} \tan 2z + [(m-1)\pi \div 2m] \text{ (sec } 2z).$$

When z is greater than 45° the $\cos 2z$ is $-$, consequently the $\tan 2z$ and $\sec 2z$ are $-$. By Position $z = 77^\circ 38' 30''$ and $r = 2R \cos z = 9.960$.

Taking the same figure, EC = length of rope inside the field = $l = 2R \cos z$, the angles being represented as before. The area required is the sector $ACBEA = l^2 z = 4zR^2 \cos^2 z$ and the segments m and n . $\therefore 4R^2 z \cos^2 z + R^2(\pi - 2z) - R^2 \sin 2z = R^2 \pi \div m \dots (B)$;

$$z = \frac{\sin 2z}{2\cos 2z} + [(\pi \div m) - \pi] \div 2\cos 2z = \frac{1}{2} \tan 2z + (1-m)\pi \div 2m - \sec 2z.$$

$$z = 76^\circ 21' 40'', l = 2R \cos z = 10.643.$$

Reducing the equation marked (B) to (C) $2z \cos 2z - \sin 2z = \pi \div m - \pi$, and let $z = \frac{1}{2}\pi - x$, then $x = \frac{1}{2}\pi - z$. Substituting this value of z in (C) gives (D) $(2x - \pi)\cos 2x - \sin 2x = (1-m)\pi \div m$, then

$$\cos 2x = 1 - (4x^2 \div 2) + (16x^4 \div 24), \sin 2x = 2x - (4x^3 \div 3) + 4x^5 \div 15,$$

$$\cos x = 1 - \frac{1}{2}x^2 + \frac{1}{24}x^4 - \text{etc.}, \sin x = x - \frac{1}{6}x^3 + \frac{1}{120}x^5 - \text{etc.}$$

Substituting these values in (D), restoring numbers, etc., gives

$$x^5 - 1.9635x^4 - 2.5x^3 + 5.8905x^2 - .2946 = 0.$$

I reduced this by Horner's method and get $x = .2380777$ giving $13^\circ 38' 27''$; $90^\circ - 13^\circ 38' 27'' = 76^\circ 21' 33''$, which is $7''$ less than I got by Position. Expanding $\cos 2x$ to x^6 and $\sin 2x$ to x^7 would give a more exact result. [For figure see next page.]

By A. F. PARSONS, *Arroyo Grande, Cal.*

Let the larger circle be the field, C the point and CD the tethering line outside the field. Put $AO=r$, and let $\varphi=\angle ACO$. Then

$$AC=2r\cos\varphi, \text{ arc } ADB=2\pi-2\varphi,$$

and its length $=2r\cos\varphi(2\pi-2\varphi)$, $AOC=\pi-2\varphi$;

hence area $AOC=\frac{1}{2}r^2\sin(\pi-2\varphi)=\frac{1}{2}r^2\sin 2\varphi$, and

area $AOBC=r^2\sin 2\varphi$; arc $AC=\pi-2\varphi$; area sector $AOC=\frac{1}{2}r^2(\pi-\varphi^2)$

and sector $OACB=r^2(\pi-2\varphi)$. $\therefore$ area of portion of circle outside is sector $CADB+2\triangle AOC$ —sector $OACB$

$$=4r^2\cos^2\varphi(\pi-\varphi)+r^2\sin 2\varphi-r^2(\pi-2\varphi),$$

or $\cos 2\varphi(2\pi-2\varphi)+\sin 2\varphi=-\frac{9}{16}\pi$; whence, by Position, we find

$$\varphi=77^\circ 37' 55\frac{1}{2}" , \text{ and } AC=2r\cos\varphi=80\sqrt{(1\div\pi)}\cos\varphi=9.6674 \text{ rods.}$$



If the field is fenced, the solution is as follows:

Draw PCP' perpendicular to DO . The arcs PA and $P'B$ are portions of an involute of circle O . Connect PC and PO , and let $x=PC=\text{arc } AC$. Put $CO=R$. Then the area grazed is the semi-circle $PDP'=\frac{1}{2}x^2\pi$, plus $\triangle OPP'=Rx$, plus $2\times$ evolute $OAP=x^3\div 3R$, minus sector $OACB=Rx=\frac{1}{10}R^2\pi$, or

$$(x^3\div 3R)+\frac{1}{2}x^2\pi=160, \text{ whence } x=9.675 \text{ rods.}$$

For length of tethering line of horse within the large circle, we find, by a method similar to the first,

$$2\varphi(2\varphi-\tan 2\varphi)=-.9\pi, \text{ whence } \varphi=76^\circ 21' 45"=ACO.$$

Then $AC=2r\cos\varphi=10.6418$ rods.

Solved by S. G. Cagwin and H. A. Wood.

- 661.** J. E. FELLERS, *La Belle, Mo.*—Find value of x in the equation,
 $3x\sqrt{7a-24-14}=2a\sqrt{x+27+37}.$

By A. L. FOOTE, *Hempstead, L. I.*

As this equation is given, its solution is as follows: Transposing, we have $3x\sqrt{7a-102}=2a\sqrt{x}$. Squaring each member,

$$63ax^2-632x\sqrt{7a+10404}=4a^2x,$$

from which $x^2-(632\sqrt{7a+4a^2})x=-10404$; completing square and extracting, we have

$$x=316\sqrt{7a+2a^2}\pm 2\sqrt{(174748a+316a^2\sqrt{7a+a^4})}.$$

Solved by Messrs. Watson and Parsons.

NOTE.—We have an ingenious solution from Mr. D. H. Davison, supplementary to his solution of Prob. 623, p. 185 of Vol. V. It will appear in next issue.

662. *By Request.*—A circular piece of land 20 rods in diameter is to be divided into three equal parts by concentric circles. Required the radii of these circles.—*Graded Problems.*

By J. W. WATSON, Middle Creek, Ohio.

Put $r = 10$ rds., radius of land. Then $\pi r^2 =$ area, and $\frac{1}{3}\pi r^2 =$ area of smallest circle, and $\frac{2}{3}\pi r^2 =$ area of second circle. Let $r' =$ radius of smallest circle, and $r'' =$ radius of second circle, then we have

$$r^2 : r'^2 :: 3 : 2. \therefore r' = r\sqrt{\frac{2}{3}} = 10\sqrt{\frac{2}{3}}; \text{ also}$$

$$r^2 : r''^2 :: 2 : 1. \therefore r'' = r\sqrt{\frac{1}{2}} = 10\sqrt{\frac{1}{2}}.$$

Solved by A. L. Foote, A. G. Gunder, Wm. Wiley, A. F. Parsons, S. G. Cagwin, J. C. Gregg and J. R. Baldwin.

663. *By Request.*—If stock bought at 10% discount pays 5% on the investment, what % will it pay if it is purchased at 30% premium.—*Id.*

By J. R. BALDWIN, Blue Grass, Iowa.

Let $100\% - 10\% = 90\%$, cost price; 5% of $90\% = 4.5\%$, the per cent. on the face. Hence, it will pay $4.5\% \div 130\% = 3\frac{6}{13}\%$.

A. L. Foote, H. A. Wood, A. F. Parsons, J. C. Gregg and J. W. Watson also furnished solutions.

664. *By Request.*—There are two copper kettle of the same weight and shape; one is made of metal twice as thick as the other. If the one of thicker metal holds a gallon, what will the other hold?—*Id.*

By W. L. HARVEY, Maxfield, Me.

Surfaces may be represented by squares and contents by cubes. Let $x^2 =$ surface, and x^3 contents of small kettle; $y^2 =$ surface and y^3 contents of large kettle; $y^2 = 2x^2$; $y = x\sqrt{2}$; $y^3 = 2\sqrt{2}x^3$; then

$$x^3 : 2\sqrt{2}x^3 :: 1 \text{ gal.} : 2\sqrt{2} \text{ gal.} = 2.8284 \text{ gal.}$$

Solved by A. L. Foote and A. F. Parsons.

665. A third-patch "square roof" is to be put on a rectangular house, 36×42 feet, with a flat deck at top 8 feet above the plates. What will be the size of the deck, what the length of the side rafters, and what the four corner rafters?—*Ole-ney.*

By A. F. PARSONS, Arroyo Grande, Cal.

The height of roof if sides are produced to a ridge will be $36 \div 3 = 12$. But as the slant terminates at a height of 8 ft., the flat deck will occupy $(12 - 8) \div 12 = \frac{1}{3}$ of width = 12 ft. Similarly the end slant will be $42 \div 3 = 14$ ft. high. The deck will be $(14 - 8) \div 14 = \frac{3}{7}$ of length = 18 ft. $\therefore$ the deck will be 12×18 ft. The side rafters will be $\sqrt{(8^2 + 12^2)} = 4\sqrt{13} = 14.422205101856$ ft., and corner rafters

$$\sqrt{(12^2 + 12^2 + 8^2)} = 4\sqrt{22} = 18.7616630398 \text{ ft.}$$

Solved by J. C. Gregg and Henry Gunder.

666. By J. C. GREGG, *Brazil, Ind.*— $2x\sqrt{1-x^4}=a(1+x^4)$. Find the value of x .—*Olney.*

By A. L. FOOTE, *Hempstead, Long Island.*

Write thus $-2x\sqrt{1+x^4}=a(1+x^4)$. Now since the $\sqrt{1}=1$, we get $-2x(1+x^4)=a(1+x^4)$. Divide by $1+x^4$, $-2x=a$ or $x=-\frac{1}{2}a$.

By HENRY GUNDER, *New Castle, Ind.*

Square, transpose all the terms to one side, divide by x^4 and subtract $4a^2$ from both members, we have

$$a^2(x^2-x^{-2})^2+4(x^2-x^{-2})=-4a^2\dots(2).$$

$$\text{From (2)} \quad x^2-x^{-2}=2[-1\pm\sqrt{(1-a^4)}]\div a^2=2n\dots(3).$$

$$\text{From (3)} \quad x^4-2nx^2=1\dots(4).$$

$$\therefore x^2=n\pm\sqrt{(1+n^2)} \text{ or } x=\pm\sqrt{[n\pm\sqrt{(1+n^2)}]}\dots(5), \quad \text{or}$$

$$x=\pm(1\div a)^{\frac{1}{4}}[-1\pm\sqrt{(1-a^4)}\pm\sqrt{[2\mp2\sqrt{(1-a^4)}]^{\frac{1}{4}}}\dots(6).$$

Solved by H. A. Wood.

667. By E. P. CLEMENS, *Spartansburg, Ind.*—A has a garden 160 feet long and 105 feet wide; he wishes to raise the surface 5 inches, by using the earth, taken from a ditch 3 feet wide dug around the garden within the fence, but finds that this earth looses 10% in bulk after being spread over the garden; what must be the depth of the ditch?

By A. F. PARSONS, *Arroyo Grande, Cal.*

The surface to be covered is 154×99 sq. yds. As the filling loses 10% in settling (?) a filling to stand 5 in., must be made $5\times\frac{10}{9}=5\frac{5}{9}$ in. $\therefore$ the amount of filling required is $154\times 99\times 9\times 1.44\times 5\frac{5}{9}$ cu. in. The surface cut out by the ditch $(160+99)\times 6=259\times 6$ sq. yds. $\therefore$ the depth to which the ditch must be dug is

$$(154\times 99\times 9\times 144\times 5\frac{5}{9})\div(259\times 6\times 9\times 144)=54\frac{56}{111} \text{ in.}$$

J. C. Gregg, A. L. Foote, Wm. Wiley and J. W. Watson also solved it.

668. By D. W. K. MARTIN, *Webster, O.*—The sum of the diagonals of the squares described on a right-angled triangle is $24\frac{1}{5}$ rods. The area of one of the squares is $5\frac{5}{8}$ acres. Required the sides of the triangle.

By A. F. PARSONS, *Arroyo Grande, Cal.*

Let x and y be the sides of the triangle. Then $x\sqrt{2}$ and $y\sqrt{2}$ will be the diagonals of the squares on those lines.

$$x\sqrt{2}+y\sqrt{2}=24\sqrt{5}\dots(1). \quad x^2=5\frac{5}{8}\times 160=900\dots(2).$$

$$\text{From (1)} \quad x+y=12\sqrt{10}\dots(3). \quad \text{From (2)} \quad x=30\dots(4). \quad \text{Hence,}$$

$$y=12\sqrt{10}-30=7.947331922020, \text{ and the hypotenuse} \\ =\sqrt{(x^2+y^2)}=6\sqrt{(90-20\sqrt{10})}=31.0350.$$

Solved by Messrs. Baldwin, Gunder and Foote.

669. By C. B. HAYDEN, *Baltimore, Md.*—One-third of all the apples on a tree are rotten, and $\frac{1}{4}$ of all the apples on the same tree are wormy. What are the respective chances that an apple taken at random from the tree will be (1) sound, (2) rotten, (3) wormy, and (4) both rotten and wormy?

By PROF. H. A. WOOD, *204 East 51st Street, New York.*

Let p , p_1 , p_2 and p_3 denote the required probabilities.

1. The apples which are sound may include none, or all, or part of those which are wormy, or rotten, or part of both. Then the least part sound $= 1 - (\frac{1}{3} + \frac{1}{4}) = \frac{5}{12}$, and the greatest part $= 1 - \frac{1}{3} = \frac{2}{3}$. Since all parts between these limits are equally likely, the chance of taking a sound apple at random from the tree is $p = \frac{1}{2}(\frac{2}{3} + \frac{5}{12}) = \frac{13}{24}$.

2. In like manner the least part rotten is $\frac{1}{3} - \frac{1}{4} = \frac{1}{12}$, and the greatest part $= \frac{1}{3}$. $\therefore$ the chance of taking an apple that is rotten only is

$$p_1 = \frac{1}{2}(\frac{1}{12} + \frac{1}{3}) = \frac{5}{24}.$$

3. The least part wormy only $= 0$; the greatest part $= \frac{1}{4}$; hence,

$$p_2 = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}.$$

4. The least part both rotten and wormy is 0; the greatest part $= \frac{1}{4}$; hence, $p_3 = \frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$.

A. F. Parsons solved it.

670. By the same.—A candle, specific gravity .8, 15 inches long and one inch in diameter, and a metallic rod 6 inches long and $\frac{1}{2}$ inch in diameter, hang vertically from the unequal arms of a balance. When the rod and 5 inches of the candle are immersed in water, they balance. When the rod is raised out of water, the candle rises one inch. What is the specific gravity of the metal?

By J. C. GREGG, A. M., *Brazil, Ind.*

Let a = weight of a cubic in. of water; then $3a\pi$ = weight of candle, and $\frac{3}{4}a\pi$ = weight of water displaced by rod. Now, let b = the candle arm of balance, c = the rod arm of balance, and x = weight of rod; and we have $\frac{3}{4}ab\pi = c(x - \frac{3}{4}a\pi) \dots (1)$. Also $2ab\pi = cx \dots (2)$. Dividing (2) by (1), we get $x = 3a\pi$. But specific gravity of rod is its weight divided by weight of water displaced; or we have

$$3a\pi \div \frac{3}{4}a\pi = 8, \text{ the required specific gravity.}$$

By HENRY GUNDER, *New Castle, Ind.*

The weight of that part of the candle out of the water may be represented by $10 \times .8 \times \frac{1}{4}\pi = 2\pi$, and the part in the water by $-5 \times .2 \times \frac{1}{4}\pi = -\frac{1}{4}\pi$. Its moment about the fulcrum of the balance is

$$(2\pi - \frac{1}{4}\pi)n = 1\frac{3}{4}\pi n,$$

where n is the length of that end of the beam. In a similar manner the moment of the rod $\frac{3}{4}\pi m(s-1)$, where m is the length of the arm and s the specific gravity of the metal. Therefore,

$$1\frac{3}{4}\pi n = \frac{3}{8}\pi m(s-1) \dots (1).$$

Similarly after raising the rod out of the water $2\pi n = \frac{3}{8}\pi ms \dots (2)$.
From (1) and (2) $n = \frac{3}{2}m$ and $s = 8$, specific gravity of the metal composing the rod.

Solved by A. F. Parsons.

671. By D. H. DAVISON, *Minonk, Ill.*—A ball being dropped from the top of a tower rebounded 40 feet high; it continued to fall and rebound until it came to rest, each rebound being proportional to its preceding fall. The whole time of the falls and rebounds being 10 seconds. How far has it traveled? What is the height of the tower?

By the PROPOSER.

Let h = height of tower. Put $a = 40$ ft., 1st rebound; $t = 10$ sec., whole time; $g = 16\frac{1}{2}$ ft., distance dropped 1st sec. Let m = ratio for ascending Geometrical series. To find time of falls and rebounds we have $\sqrt{(ma \div g)} + \sqrt{(a \div g)} + \sqrt{(a \div gm)} + \sqrt{(a \div gm^2)} \dots$ to infinity = time of falls, and $\sqrt{(a \div g)} + \sqrt{(a \div gm)} + \sqrt{(a \div gm^2)} \dots$ to infinity = time of rebounds; take 1st term = 0, and last term = $\sqrt{(ma \div g)}$ in series of falls, and last term = $\sqrt{(a \div g)}$ in series of rebounds; then by the Geometrical formula to find sum of an infinite ascending series, viz.: $s = r \div (r - 1)$, we have $m\sqrt{a \div g} \div \sqrt{g}(\sqrt{m} - 1)$ = sum of 1st series time of falls; and $\sqrt{ma \div g} \div \sqrt{g}(\sqrt{m} - 1)$ = sum of 2d series time of rebound, hence whole time $t = (m\sqrt{a} + \sqrt{ma}) \div \sqrt{g}(\sqrt{m} - 1)$, cleared, transposed, condensed and arranged gives

$$m\sqrt{a} - (t\sqrt{g} - \sqrt{a})\sqrt{m} = -t\sqrt{g},$$

a complete quadratic, from which

$$\{\sqrt{m} = t\sqrt{g} - \sqrt{a} \pm \sqrt{[(t\sqrt{g} - \sqrt{a})^2 - 4t\sqrt{ag}]} \} \div 2\sqrt{a},$$

squared gives $m = (1 \div 4a) \{t\sqrt{g} - \sqrt{a} \pm \sqrt{[(t\sqrt{g} - \sqrt{a})^2 - 4t\sqrt{ag}]} \}^2$. As ma = height of tower = h , we have by substitution the general formula $h = \frac{1}{4} \{t\sqrt{g} - \sqrt{a} \pm \sqrt{[t\sqrt{g}(t\sqrt{g} - 6\sqrt{a}) + a]} \}^2$; restoring values, $h = \frac{1}{4} (33.7794762 \pm 11.2468817)^2 = 126.929453$ or 506.843226 feet, either value fulfilling the conditions of the problem.

To find distance travelled by ball: Divide height of tower by first rebound gives ratio = r ; hence $126.929453 \div 40 = 3.173236 = r$. The first term of the ascending series being 0, and last term = 40, by formula to find sum of an infinite ascending series, we have

$$3.17326 \times 40 \div 2.173236 = 58.405739 \text{ ft.},$$

sum of rebounds; doubling gives rebounds and subsequent falls = 116.811478, to which add the first fall 126.929453, gives 243.740931 ft., whole distance traveled. In like manner taking height of tower 506.843226 ft., we find the whole distance traveled is 593.697775 ft. $\therefore$ 243.74093 ft. traveled by ball when 126.92945 ft. = height of tower, and 593.69777 ft. traveled by ball when 506.84322 ft. = height of tower.

Also solved by Henry Gunder and A. F. Parsons.

650. How many monograms consisting of any number of letters from 2 to 26, can be formed from our alphabet?

By A. F. PARSONS, Arroyo Grande, Cal.

The number of monograms, using the 26 letters, equals the number of permutations of 26 letters, which is

$$A = 403,291,461,126,605,635,584,000,000.$$

For the sake of brevity, let the letters a, b, c , etc., represent the numbers of their places from the first, and after the combinations containing a, b, c , etc., are exhausted, let the letters be dropped, in the order in which they stand. Thus, the number of monograms using all the letters will be $a, b, c, \dots x, y, z = A$.

The number of monograms using 25 letters each time will equal the number of permutations of 25 letters, multiplied by the possible combinations of 25 letters of 26. Thus for 25 letters we will have

$$a.b.c \dots w.x.y \times \frac{b.c.d \dots x.y.z}{a.b.c \dots w.x.y} = B = A.$$

The number of different monograms, using 24 letters in each, will equal the number of permutations of 24 objects, multiplied by the number of different combinations of 24 out of 26 objects, or

$$a.b.c \dots v.w.x \times \frac{c.d.e \dots x.y.z}{a.b.c \dots v.w.x} = C.$$

$$= c.d.e \dots v.w.x.y.z = 201,645,730,563,302,817,792,000,000.$$

Similarly, for 23 letters the number of monograms is

$$d.e.f \dots x.y.z = D = 67,215,243,521,100,939,264,000,000.$$

For 22 letters we likewise obtain

$$e.f.g \dots x.y.z = E = 16,803,810,880,275,234,816,000,000.$$

And so on to $x.y.z = X = 15,600$ for three letters and $y.z = Y = 650$, for two letters.

Then for all possible monograms, we have

$$A+B+C+\dots+X+Y = 1,096,259,851,353,149,530,211,034,250.$$

We take pleasure in presenting A. F. Parsons' solution of this interesting problem. He is no doubt correct in his method, by taking AB and BA , for instance, as two monograms. He is an ingenious and patient worker, whose conclusions are generally reliable. We have heard from W. Wiley, who gave the number of combinations only in his solution on page 233, last month's issue, considering AB and BA as one monogram; but he has re-considered and adopts Mr. Parsons' method. H. Gunder favored us with a good discussion, entertaining the same views as Mr. Parsons. Thank you, gentlemen, for your courtesy and excellent views on this subject.

Problems for Solution.

690. *By A. G. GUNDER, Darke, Ohio.*—A, in running a race with B to a post and back, met him 10 yards from the post. To make it a dead heat, B should have increased his rate from this point $41\frac{1}{2}$ yards per minute; but if without changing his pace, he had turned back on meeting A, he would have come out 4 seconds after him. How far was it to the post?

691. *By the same.*—The hypotenuse of a right triangle is 20, and its area is 96. Determine the sides.

692. *By* ED. RYNEARSON, *Gettysburg, Ohio.*—A merchant bought 15 pieces of cloth, each containing 20 yards, at $\$5\frac{1}{4}$, on a credit of 8 months, and sold them at $\$6\frac{1}{8}$, on a credit of 3 months; what was his cash gain at 6%?—*From Brooks.*

693. *By Request.*—A merchant buys goods for \$475.60, and after keeping them on hand 7 months, sells the same for \$560.80; what per cent profit does he make, money being worth 6%?

694. *By* J. R. BALDWIN, *Blue Grass, Iowa.*—Prove that any prime number which, when divided by 4, leaves a remainder of unity, is the sum of two square numbers.

695. *By* B. F. BURLISON, *Oneida Castle, N. Y.*—Solve the equation

$$\left(\frac{w^4-1}{w^{12}}\right)^{\frac{1}{4}} + \left(\frac{w^2-1}{w^4}\right)^{\frac{1}{4}} = 1.$$

696. *By* W. L. HARVEY, *Maxfield, Me.*—A bird sits on the top of a tree 50 feet high. How high above the top of the tree must a boy, standing 100 feet from the tree, aim his arrow, to hit the bird, the velocity of the arrow at starting being 100 feet per second?

697. *By* N. R. OLIVER, M. D., *Dorchester Station, Ontario, Can.*—Suppose a pole 156 feet high and upon its top sits a bird at which three men are to shoot, all of them at equal distances from the pole. A is 50 feet from B, B 66 feet from C, and C 104 feet from A. How far must he shoot, who hits the bird?

698. *By the same.*—Solve the equations,

$$\begin{aligned} x^2 + y^2 &= 13900 + x^3 \dots (1), \\ x^3 + y^3 &= 654508000000 + y^4 \dots (2). \end{aligned}$$

699. *By the same.*—There is a mould candle 15 inches long, which will burn in an arithmetical progression for 9 hours; if an inch at the lesser end is consumed 20 minutes sooner than the same length at the larger end, how long will the first inch burn?

700. *By the same.*—Suppose a spiral tube winds round a cylindrical tower, making an angle of $60^\circ 5'$ with the horizon, and a ball falls freely from the vertex along the tube by its own gravity in 8 seconds. Required the perpendicular height of tower.

701. *By Request.*—A bought 450A. 48P. of land, at \$2 an acre, borrowing the money to pay for it at 5%. After 3 yr. 7 mo. 19 da., he sold it at an advance of \$299.40 on cost. If meanwhile he paid \$45.25 for taxes on the land, did he gain or lose by the speculation, and how much?—*Royer's Problems in Mathematics.*

702. *By the Editor.*—The length and breadth of a school-room are as 8 to 5, but if it were 2 feet longer and 2 feet wider, the area of the floor would be 1600 sq. ft. Required, the dimensions, without the aid of algebra.

703. *By the Editor.*—Find solidity of a slab one foot wide and 6 ft. 9 in. long, sawed from a cylindrical log 20 inches in diameter.

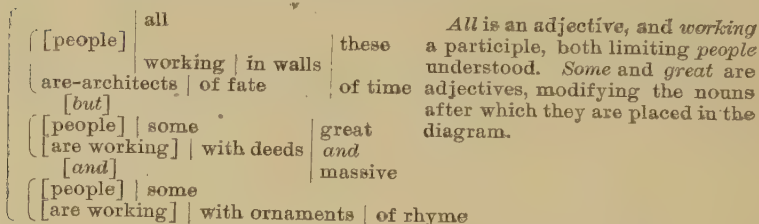
Solutions should be received on or before Feb. 23.

MISCELLANEOUS DEPARTMENT.

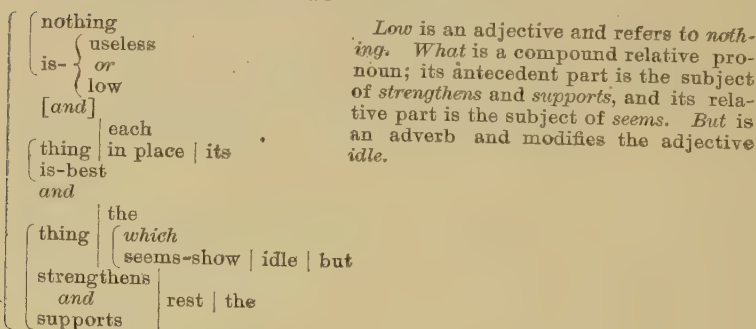
We propose to embrace Grammar, Notes and Queries, and Examination Questions in the *Miscellaneous Department* hereafter, and make it practical, interesting and indispensable to the teacher and student.

U. H. Daniels requests diagrams of the following sentences which we deem of general interest.

1. *All* are architects of fate,
 Working in these walls of time;
Some with massive deeds and *great*,
 Some with ornaments of rhyme.



2. Nothing useless is or *low*;
 Each thing in its place is best;
And *what* seems *but* idle show
 Strengthens and supports the rest.



3. So *live*, that when thy summons comes to join
The innumerable caravan which moves
To that mysterious realm where each shall take
His chamber in the silent halls of death,
Thou go not, like the quarry slave at night
Scourged to his dungeon, but *sustained* and soothed
By an unfaltering trust, *approach* thy grave
Like *one* who wraps the drapery of his couch
About him and lies down to pleasant dreams. — *Bryant*.

NOTE. — This page does not admit the diagram. Will some of our friends forward diagrams by the above method for publication in the next issue,

J. W. Beard has called for the Cabinet Officers of all the administrations. We quote from Cromer's *Historical Outlines*, designating the departments in the following order: 1 Sec'y of State, 2 Sec'y of Treasury, 3 Sec'y of War, 4 Sec'y of Navy, 5 Sec'y of Interior, 6 Attorney General, 7 Postmaster General.

Washington.

1 Thomas Jefferson, Va., Edmund Randolph, Va., and Timothy Pickering, Mass.; 2 Alex. Hamilton, N. Y., and Oliver Wolcott, Conn.; 3 Henry Knox, Mass., and Timothy Pickering, Mass.; 6 Edmund Randolph, Va., and William Bradford, Pa.

Adams.

1 Timothy Pickering, Mass., and John Marshall, Va.; 2 Oliver Wolcott, Conn., and Samuel Dexter, Mass.; 3 Jas. McHenry, Md., and Samuel Dexter, Mass.; 4 Benjamin Stoddert, Md.; 6 Charles Lee, Va., and T. Parsons, Mass.

Jefferson.

1 James Madison, Va.; 2 Albert Gallatin, Pa.; 3 Henry Dearborn, Mass.; 4 Robert Smith, Md., and Jac. Crowinshield, Mass.; 6 Levi Lincoln, Mass., Rob't Smith, Md., John Breckinridge, Ky., and Cæsar A. Rodney, Del.

Madison.

1 Rob't Smith, Md., and Jas. Monroe, Va.; 2 Albert Gallatin, Pa., Geo. W. Campbell, Tenn., and A. J. Dallas, Pa.; 3 Wm. Eustis, Mass., John Armstrong, N. Y., James Monroe, Va. and Wm. H. Crawford, Ga.; 4 Paul Hamilton, S. C., Wm. Jones, Pa., and B. W. Crowinshield, Mass.; 6 Cæsar A. Rodney, Del., Wm. Pinckney, Md., and Richard Rush, Pa.

Monroe.

1 John Quincy Adams, Mass.; 2 Wm. H. Crawford, Ga.; 3 John C. Calhoun, S. C.; 4 B. W. Crowinshield, Mass., Smith Thompson, N. Y., and Samuel L. Southard, N. Y.; 6 Richard Rush, Pa., and Wm. Wirt, Va.

Adams.

1 Henry Clay, Ky.; 2 Richard Rush, Pa.; 3 James Barbour, Va., and Peter Porter, N. Y.; 4 Samuel L. Southard, N. J.; 6 Wm. Wirt, Va.

Jackson.

1 Martin Van Buren, N. Y., Edward Livingstone, La., Louis McLane, Del., and John Forsyth, Ga.; 2 Samuel D. Ingham, Pa., Louis McLane, Del., Wm. J. Duane, Pa., Roger B. Taney, Md., and Levi Woodbury, N. H.; 3 John H. Eaton, Tenn., and Lewis Cass, Mich.; 4 John Branch, N. C., Levi Woodbury, N. H., and Mahlon Dickerson, N. J.; 6 John M. Berrien, Ga., Roger B. Taney, Md., and Benj. F. Butler, N. Y.; 7 Wm. T. Barry, Ky., and Amos Kendall, Ky.

Van Buren.

1 John Forsyth, Ga.; 2 Levi Woodbury, N. H.; 3 Joel R. Poinsett, S. C.; 4 Mahlon Dickerson, N. J., and Jas. K. Paulding, N. Y.; 6 B. F. Butler, N. Y., Felix Grundy, Tenn., and Henry D. Gilpin, Pa.; 7 Amos Kendall, Ky., and J. M. Niles, Conn.

Harrison and Tyler.

1 Daniel Webster, Mass., Hugh S. Legare, S. C., Abel P. Upshur, Va., and John C. Calhoun, S. C.; 2 Thos. Ewing, Ohio, Walter Forward, Pa., John C. Spencer, N. Y., and Geo. M. Bibb, Ky.; 3 John Bell, Tenn., Jno. C. Spencer, N. Y., Jas. M. Porter, Pa., and Wm. Wilkins, Pa.; 4 George E. Badger, N. C., Abel P. Upshur, Va., David Henshaw, Mass., Thos. W. Gilmer, Va., and John Y. Mason, Va. 6 John J. Crittenden, Ky., Hugh S. Legare, S. C., and John Nelson, Md.; 7 Francis Granger, N. Y., and Charles A. Wickliffe, Ky.

Polk.

1 James Buchanan, Pa.; 2 Robert J. Walker, Miss.; 3 Wm. L. Marcy, N. Y.; 4 George Bancroft, Mass., John Y. Mason, Va.; 6 John Y. Mason, Va., Nathan Clifford, Me., Isaac Toucey, Conn.; 7 Cave Johnson, Tenn.

Taylor and Fillmore.

1 John M. Clayton, Del., Daniel Webster, Mass., Edward Everett, Mass.; 2 Wm. M. Meredith, Pa., Thomas Corwin, Ohio; 3 Geo. W. Crawford, Ga., Chas. M. Conrad, La.; 4 Wm. B. Preston, Va., Wm. A. Graham, N. C., John P. Kennedy, Md.; 5 Thos. Ewing, Ohio, Alex. H. H. Stuart, Va.; 6 Reverdy Johnson, Md., John J. Crittenden, Ky.; 7 Jacob Collamer, Vt., Nathan K. Hall, N. Y., Samuel D. Hubbard, Conn.

Pierce.

1 Wm. L. Marcy, N. Y.; 2 James Guthrie, Ky.; 3 Jefferson Davis, Miss.; 4 James C. Dobbin, N. C.; 5 Robert McClelland, Mich.; 6 Caleb Cushing, Mass.; 7 James Campbell, Pa.

Buchanan.

1 Lewis Cass, Mich., Jeremiah S. Black, Pa.; 2 Howell Cobb, Ga., Philip F. Thomas, Md.; 3 John B. Floyd, Va., Joseph Holt, Ky.; 4 Isaac Toucey, Conn.; 5 Jacob Thompson, Miss.; 6 Jeremiah S. Black, Pa., Edwin M. Stanton, Pa.; 7 Aaron V. Brown, Tenn., Joseph Holt, Ky., Horatio King, N. H., Montgomery Blair, Md.

Lincoln and Johnson.

1 Wm. H. Seward, N. Y.; 2 Salmon P. Chase, Ohio, Wm. P. Fessenden, Me., Hugh McCulloch, Ind.; 2 Simon Cameron, Pa., Edwin M. Stanton, Pa., U. S. Grant, Ill., *ad interim*, John M. Schofield, Mo.; 4 Gideon Welles, Conn.; 5 Caleb B. Smith, Ind., John P. Usher, Ind., James Harlan, Iowa, Orville H. Browning, Ill.; 6 Edward Bates, Mo., Jas. Speed, Ky., Henry Stanberry, Ohio; Wm. M. Evarts, N. Y. 7 Montgomery Blair, Md., Wm. Dennison, Ohio; Alex. W. Randall, Wis.

Grant.

1 Elihu B. Washburne, Ill., Hamilton Fish, N. Y.; 2 Geo. S. Boutwell, Mass., Wm. A. Richardson, Mass., Benjamin H. Bristow, Ky., Lot M. Morrill, Me.; 3 John A. Rawlins, Ill., Wm. W. Belknap, Iowa, Alphonso Taft, Ohio, James D. Cameron, Pa.; 4 A. E. Borie, Pa., G. M. Robeson, N. J.; 5 Jacob D. Cox, Ohio, Columbus Deland, Ohio; Zachariah Chandler, Mich.; 6 E. R. Hoar, Mass., A. T. Akerman, Ga., George H. Williams, Oregon, Edward Pierrepont, N. Y., Alphonso Taft, Ohio; 7 J. A. J. Creswell, Md., Marshall Jewell, Conn., James N. Tyner, Ind.

Hayes,

1 Wm M. Evarts, N. Y.; 2 John Sherman, Ohio; 3 Geo. W. McCrary, Iowa, and Alex. Ramsey, Minn.; 4 Richard M. Johnson, Ind., and Nathan Goff, W. Va.; 5 Carl Schurz, Mo.; 6 Charles Devens, Mass.; 7 David M. Key, Tenn., and Horace Maynard, Tenn.

Garfield and Arthur.

1 James G. Blaine, Me., Frederick T. Frelinghuysen, N. J.; 2 Wm. Windom, Minn., Chas. J. Folger, N. Y.; 3 Robert T. Lincoln, Ill.; 4 Wm. H. Hunt, La., Wm. E. Chandler, N. H.; 5 Samuel J. Kirkwood, Iowa, Henry M. Teller, Col.; 6 Wayne McVeagh, Pa., Benjamin H. Brewster, Pa.; 7 Thos. L. James, N. Y., Timothy O. Howe, Wis., Walter Q. Gresham, Ind.

ARTHUR'S PRESENT CABINET.—*Secretary of State*, Frederick T. Frelinghuysen, N. J.; *Secretary of Treasury*, Hugh McCulloch, Ind.; *Secretary of War*, Robert T. Lincoln, Ill.; *Secretary of Navy*, Wm. E. Chandler, N. H.; *Secretary of Interior*, Henry M. Teller, Col.; *Attorney General*, Benjamin H. Brewster, Pa.; *Postmaster General*, Frank Hatton, Iowa.

Editorial Notes.

S. G. Cagwin sent a solution of problem 630, but it came too late for the Nov. issue.

The answers to queries and the solutions of problems will be unusually interesting next month.

ERRATA.—Eq. (1) of Prof. Hoover's solution of Prob. 540, page 209, should be $ax = (r+a)\theta$.

Answer to L. A. Reed's solution of Prob. 646, p. 230, Dec. No., should be 10.35 instead of 15.25. Please mark these errors.

Page 239, last month's issue, the second part of the answer to the first question in Geography, should read *slightly south*, instead of *slightly north*.

In diagram on page 17 of this issue, the adverbial clause should modify *had became*. On same page, in 2d question, *potatoes* should be *potato*. On page 22, 7th line of answer to query 508, read $1\frac{9}{16}^{\circ}$ instead of $1\frac{9}{8}$.

Our contributors should write on one side of the paper only, and attach the signature to each problem, query, solution and answer. References to authorities consulted would add much to the value of the answers sometimes. Good pencil writing on tablet paper is satisfactory and very convenient. If querists would give a brief answer, or state how the question was suggested if asked for information, it would aid the editor in furnishing answers.

We take pleasure in expressing our thanks to the following friends who have sent us clubs for 1885. D. W. K. Martin, of this county has already secured fifteen names and is still adding to the list. A. F. Smelker, Orlando Gower, D. G. Wenrick, Isaac Oliver and W. W. Teegarden, all of this county have sent clubs. Dr. L. A. Mathias, of Enterprise, Ohio, favors us with fifteen names and expects to send more. W. C. Binkley, post-office clerk at Cincinnati, Jos. Lambach, Delphos, Geo. W. Leaby, Marshallville, Wm. S. Davidson and Warren Loy, Pymont, J. W. Watson, Middle Creek, and L. L. Haskins, Cleveland, all of this state, have taken sufficient interest in the *Visitor* to secure subscribers. Prof. H. A. Wood, New York City; S. G. Cagwin, New London, N. Y.; Dr. N. R. Oliver, Dorchester, Ontario; D. H. Davison, Minonk, Ill.; J. E. Fellers, La Belle, and J. M. White, Burlington Junction, Mo.; T. N. Haun, Midway, Tenn.; J. R. Baldwin, Blue Grass, Iowa; Jacob Huber, Deerfield, Ind.; Wm. Blair, New Salem, W. Va.; J. L. Teller, Mt. Olive, and J. Monroe Hottel, Woodstock, Va.; all have secured subscribers, and expressed an abiding interest in the welfare of our magazine. Will each of our subscribers of 1884, who reads this, determine to send at least one new subscriber with his renewal? Let us hear from you, kind friends.

Examination Questions.

ARITHMETIC.

1. From 4 oz. 5 pwt. of gold I made 12 rings, and, after giving away one sold the others at 4ϕ a grain. How much did I receive for them?

Ans.—Each ring weighed $2040 \div 12 = 170$ grains; $(2040 - 170) \times .04 = \74.80 .

2. Divide the product of $6\frac{3}{4}$ and $8\frac{3}{4}$ by their difference.

Ans.— $26\frac{2}{3}$.

3. What is the value of a pile of "four-foot" wood 80 ft. long and 16 ft. high, at \$5.60 per cord? What will it cost to saw this wood, each stick being sawed into four pieces, if it costs $62\frac{1}{2}\phi$ per cord to saw each stick into two pieces?

Ans.—The value of the pile is $10 \times 4 \times 5.60 = \224 . The sawing at the rate of $62\frac{1}{2}$ cents for one cut is $40 \times (62\frac{1}{2} \times 3) = \75 .

4. One agent sold a house for \$3,500, at 1%; another sold a farm for \$100 more, and sent me \$45 less than the first. What rate did the second charge?

Ans.—The first agent sent $\$3500 - (3500 \times .01) = \3465 ; the second charged $\$3600 - (\$3465 - \$45) = \180 or 5%.

5. A man lent a sum of money for 3 yr. 9 mo. and 24 da. at 6% , and received for interest \$54.96. What sum did he lend?

Ans.—He lent $\$54.96 \div .229 = \240 .

6. A and B sold a house for \$1,800. A gained 20% , B lost 20% . What was the difference in the cost of the houses?

Ans.—The required difference is $(1800 \div .80) - (1800 \div 1.20) = \700 .

7. What sum of money must be invested in 4% bonds, selling at 125, to give an annual income of \$2,500? What rate of interest is received on the investment?

Ans.—The investment must be $\$2500 \div .04 \times 1.25 = \78125 ; the rate of interest is $2500 \times 100 \div 78125 = 3.2\%$.

8. The product of three factors is 1536. One of the factors is 12, and the remaining factors are to each other as 1 to 2. What are the factors?

Ans.—The product of the two required factors is $1536 \div 12 = 128$; the least factor is, therefore, $\sqrt{[128 \div (1 \times 2)]} = 8$, and the other 16.

9. A horse was tied by a rope 52 feet long, fastened to the top of a stake 20 feet high. Find area grazed.

Ans.—We have $\sqrt{(52^2 - 20^2)} = 48$ as the radius of circle grazed; then the required area is $48^2 \times 3.1416 \div 272\frac{1}{4} = 29.245$ sq. rds.

10. A drinking cup is 3 inches in diameter at the bottom, 5 inches at the top, and 6 inches high. Find the contents.

Ans.—The contents may be found by the ordinary rule, or by a better rule, $[5^2 + 3^2 + (5 \times 3)] \times .7854 \times \frac{6}{3} = 76.9692$ cu. in.

GRAMMAR.

1. Compare *little, nigh, late, up* and *disgraceful*.

ANS. Compar. and Superl. are—less, least; higher, highest or next; later or latter, latest or last; upper, uppermost; more disgraceful, most disgraceful.

2. Give the plurals of *potatoes, staff, chimney, cargo, focus*.

ANS.—Potatoes, staves or staffs, chimneys, cargoes, focuses or foci.

3. What is the difference between a possessive pronoun and a pronoun and a pronoun in the possessive case?

ANS.—Harvey, Burns and a few others distinguish the two forms of the possessive personal pronouns, but there is really no need of such distinction. Gould Brown says, "Most of the personal pronouns have two forms of the possessive case, in each number." We think the forms *mine, thine, ours, yours, hers* and *theirs*, are equivalent to *my, thy, our, your, her* and *their*, differing etymologically only to answer a specific purpose; the first forms being used when the governing noun is understood or precedes the pronoun, and the latter when the governing noun is expressed or is followed by *own*. Good usage allows us to say,—*That seat is Imogene's, This piano is Luella's piano, That ottoman is hers, The estate is her estate, Baby mine, and my own baby.* *Imogene's* is in the possessive case, possessing *seat* understood, and *hers* is a personal pronoun, in the possessive case; it possesses *ottoman* understood. *Mine* is a personal pronoun, possessive case, possessing *baby*.

4. Conjugate the verb *learn* in the present tense, subjunctive mood, progressive form.

5. Write a sentence containing a preposition in an adjective phrase and one in an adverbial phrase.

ANS.—The teacher, *intent on duty* and *ambitions only of usefulness*, bears *in the beaming eye* and earnest voice unfailing evidence of *inward peace and joy*.

6. Correct—*The apples taste sweetly*. Give reason for the correction.

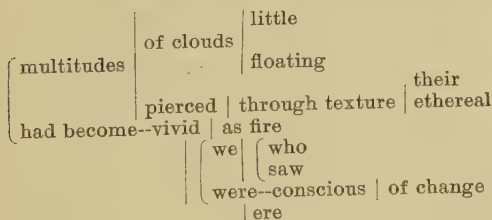
ANS.—The apples taste sweet. Adverbs should not be used for adjectives to denote quality of objects.

7. Parse—*Mary, tell John to bring me his book*.

ANS.—*Mary* is in the absolute case by direct address. *Tell* is a transitive verb; it has *you* understood for its subject, and governs *John* in the objective case. *To bring* is an infinitive with the construction of an adjective, limiting *John*, and it governs *book* in the objective case. *Me* is the object of *to understand*.

8. Diagram—Multitudes of little floating clouds,

Ere we, who saw, of change were conscious, pierced
Through their ethereal texture had become vivid as fire.



9. Name a masculine noun and its corresponding feminine; a masculine noun which has no corresponding feminine, and a feminine noun which has no corresponding masculine.

Ans.—(a) Boy, girl; (b) doctor; (c) milliner.

10. Write on one of these topics a short essay:

1. School discipline, or the moral nature.
2. The teacher's preparation for the day's lessons.
3. Elementary science teaching in primary schools.
4. Elementary science teaching in grammar schools.
5. The art of questioning.

FIRST TOPIC.—The object of school discipline is to secure good conduct and establish right character. To repose confidence in pupils develops self-respect and increases their manhood and womanhood. It is important to know how far to trust pupils and yet secure these results. Too much trust becomes a temptation, and the force of character and sense of right will weaken and the work of government will be materially lessened. Never show a suspicion upon your part that the pupils might be guilty of a misdemeanor, but make them feel that your greatest desire is to do them good. The teacher should be an individual of strong personality, lofty purposes, and with a heart and soul full of enthusiasm for his work. To the teacher's guidance are given the chubby palms of trusting childhood, and the efficient teacher should endeavor to lead them aright.

SPELLING.

Accession, beneficent, dissertation, facile, hypocrisy, jole, Magna Charta, orgeat, quoin, pacer, knavish, condescension, excursion, germane, incite, lyrist, nucleus, polltax, pleuropneumonia, exscind.

GEOGRAPHY.

1. Name two rivers that empty into the North Sea, two that empty into the Black Sea, and one that empties into the Arctic Ocean.
2. Name five seas that border Europe on the south.
3. Locate Marseilles and Montreal, and state for what each is noted.
4. Name three islands in the Mediterranean Sea, and two near North America.
5. What is a Gulf? Locate one.
6. What Strait connects the English Channel with the North Sea, and what the Arctic with the Pacific Ocean?
7. Compare East and West Europe with regard to climate.
8. In what zone is the greater part of South America? What is its climate?
9. Name five agricultural products of South America.
10. Name five important manufactures of Europe.

NOTE.—We consider these questions too easy for answers here. The reader is referred to the text-book, if he can not answer them readily.

HISTORY.

1. Give an account of the surrender of Lord Cornwallis.

ANS.—The siege of Yorktown commenced Sept. 30, 1781, by the combined French and American forces, and on Oct. 19, Cornwallis surrendered Yorktown with 12,000 prisoners, 8000 muskets, 235 cannons, 28 standards, besides munitions and stores. When the news arrived at Philadelphia the next morning, the people wept with delight, and the old door-keeper of Congress died of joy.

2. (a) When was Indiana Territory separated from Ohio? (b) Who was its first Governor?

ANS.—In 1801, when William Henry Harrison was appointed as the first territorial governor.

3. How was Texas acquired by the United States?

ANS.—In 1832 a revolution began to be organized against the Mexican government, and Nov. 12, 1835, organized a provisional government, choosing Henry Smith provisional governor. It declared itself free March 2, 1836. A convention of Texans March 17, 1836, elected D. G. Burnett first president of the Republic of Texas. Its independence was secured by treaty with Santa Anna, April 22, 1836, and in 1837 applied for admission to the United States. Three days before James K. Polk was inaugurated, President Tyler signed the bill for the annexation of Texas which was ratified by the legislature of Texas, July 4, 1845. It was admitted Dec. 29, 1845, with a debt of \$7,500,000.

4. Why was slavery finally established in the South, rather than in the North?

ANS.—We presume the climate, nature of manual labor, condition of society and the power of circumstances, determined the location of slavery.

5. What is meant by States' rights?

ANS.—The rights and powers exercised by the several States, which have not been given to the National Government, nor denied to the States.

6. What is the relation of the U. S. Government to the Indians?

ANS.—The United States acts as a kind of guardian over the Indians, and under the practical workings of the so-called "peace policy," the Indians have received much aid in the way of agricultural implements, schools and churches.

7. (a) Where and (b) when was the first railroad built in the United States?

ANS.—The first railway was completed at Quincy, Mass., in 1827, by Gridley Bryant and T. H. Perkins, for the transportation of the granite used for the Bunker Hill monument. It was operated by horse-power, the wooden rails of the track being plated with iron. The first locomotive trip made in this country was in 1828, upon the Carbondale and Honesdale R. R., by Horatio Allen, an engineer of New York, with an engine brought from England. The road ran from the Lackawaxen Canal to the Lackawanna River, affording transportation for the coal from Luzerne County, Pa.

8. On what conditions was Missouri admitted into the Union?

ANS.—On conditions of the "Missouri Compromise" which permitted slavery in Missouri, the State was admitted Aug. 10, 1821.

9. (a) By whom was the first motion made in Congress for a Declaration of Independence? (b) By whom was the Declaration written?

ANS.—(a) By Richard Henry Lee. (b) By Thos. Jefferson.

10. How do you teach History?

ANS.—By the topic method.

Answers to Queries.

493. What was the Feudal System?

ANS.—The barbarians who overthrew the Roman empire acknowledged as supreme authority some great chieftain. In that age of incessant warfare the chief was nearly always a man whose strength, skill, and daring enabled him to excel in feats of battle. The invaders parceled out the lands of the conquered, allotting a large portion to the king or principal chieftain, and smaller portions to the subordinate chiefs and freemen, according to the German custom which allowed every freeman a portion of land. In that age of violence the individual could not hope to hold this land and enjoy its fruits in peace. Union was necessary to protection. Hence the chieftain granted the right of using the lands to his followers, and they in turn agreed to take up arms in defense of the chieftain and for the common weal. The king could, from his large domain, make grants to any one. This grant was called a *feudum* or *fief*, and the tenure by which it was held a *feudal tenure*.

The chief influences which contributed to its downfall were: (1) The rise of cities which, as in the case of the Hanseatic league and the Italian republics, became very powerful. (2) The influence of royalty, which begun to be exerted against the feudal system because of the insubordination of the great barons. (3) The clergy, which constantly sought to aggrandize the church at the expense of all other powers.

Feudalism flourished from the 9th to the 13th century.—*Teachers and Students' Library*.

J. H. W. SCHMIDT.

495. What was the Conway Cabal?

ANS.—It was a scheme formed among a few members of Congress and officers of the army in the winter of 1777-8, to deprive Washington of his command, and give it to Gates or Lee. Both of these ambitious men sought the honor, and the former was fully identified with the clandestine movements to attain the position. The chief actor, however, was Gen. Conway, an Irishman by nativity who had come to this country with French allies, and appointed by Congress as Inspector-General. The plot was discovered and defeated, the army and people sustaining Washington, before whom Conway was led to make an humble apology for his conduct.

E. M. OWENS.

496. How was Shays' Insurrection put down?

ANS.—In Jan., 1787, Daniel Shays, at the head of nearly 2,000 men, marched to capture the arsenal at Springfield, Mass., but was opposed by the militia under Gen. Shepherd. The insurgents being fired upon, fled, and left on the field three killed and one wounded. The next day they were pursued by a larger force under Gen. Benj. Lincoln, and at Netersham 150 were taken prisoners, the rest dispersed and the leaders made their escape into New Hampshire. A free pardon offered to all who would lay down their arms, was generally accepted; 14 were tried and sentenced to death, but afterwards pardoned. Shays sought safety in Vt., and at his petition was pardoned. WM. S. DAVIDSON.

498. Give a full explanation of the arithmetical solution of Prob. 116, in Dec. *Visitor*, 1880.

ANS.—The solutions given are not strictly arithmetical, but are deduced from formulæ obtained by the application of algebra to geometry. The last solution is on the principle that the sum of two numbers multiplied by their difference equals the difference of their squares.

J. M. WHITE.

499. Why is a striped pole the sign used by barbers?

ANS.—In former times the barber performed the art of surgery, principally blood-letting, and the sign consisted of a striped pole with a pendant basin attached. The fillet round the pole indicated the ribbon for bandaging the arm in bleeding, and the basin the vessel to receive the blood. The use of these symbols is still preserved.—*Britannica*.

500. Give a description of the lake called the "Roof of the World."

Ans. Lake Sir-i-kol, called the "Roof of the World," is situated on the tableland of Pamir in Asia. It covers an area of fourteen square miles and is the highest lake on the globe being 15,600 feet above the sea-level. This lake is the source of the river Amoo. It is supplied with water from the snow-capped mountains which encircle it and rise to the height of 3500 feet above the level of the sea.

DELIA GARVER.

501. Name the inventor and date of invention of the locomotive, microscope, pianoforte, thermometer, watch, fire engine, gas, matches, glass, torpedo, electric light and engraving.

Ans.—The idea of the construction of a locomotive was thrown out by Watt, who patented one in 1784. [We think Mr. Murdock, an engineer in the works of Boulton & Watt, was the real inventor.—Ed.]

Single microscopes in the form of glass globes containing water were used by the ancients, but it is now generally believed to have been invented by Zacharias Jansen, assisted by his father, Hans Jansen, spectacle maker at Middleburg, about 1590.

The idea of the pianoforte was conceived independently, about the same time, by three persons in different parts of Europe: a German organist, C. A. Shroeter, 1717; Marius, harpsichord maker, 1716; and Bartolommeo Christofali, a harpsichord maker of Padan, 1814. Priority in point of invention is due to the latter.

The invention of the thermometer is variously ascribed to Drebbel, of Holland, 1609, though some ascribe it to Galileo who is said to have constructed one prior to 1597.

Watches are said to have been first invented at Nuremberg in 1477, although it is affirmed that Robert King, of Scotland, had a watch in 1310. The invention of spring watches has been ascribed to Robert Hooke, 1658. The anchor escapement was invented by Clement in 1680.

Ctesibius is believed to have invented a species of fire engine 250 B. C. But no distinct description of a fire engine of the kind exists till Hautsch, of Nuremberg, constructed his engine about 1657.

Gas was first introduced by Van Helmont. He had no accurate knowledge of the gas which he produced or examined, but made the important discovery that air diminishes in bulk when bodies are burned in it in 1600–1625.

Friction matches were invented in England by Walker in 1827.

The probable inventors of glass were the Phoenicians, who are said by Pliny to have discovered its manufacture from accidental fusion of sand and nitric in fire. The earliest examples of glass existing of which the dates are attested by inscriptions are of Egyptian origin. There is no evidence that glass was employed in windows before the 3d or 4th century. The first glass manufactory in America was established in N. H. in 1790.

The torpedo was invented by David Bushnell in 1777.

Electric light was first obtained by Sir Humphrey Davy in 1813 while experimenting with the great battery of the Royal Institution in London.

The Chinese practiced the art of engraving as early as 1000, and is supposed to have been introduced in Europe about the middle of the 15th century. Engraving on glass was perfected by Bourdien in 1799.

THOS. BRAWLEY.

502. What root is so highly prized in the East that it often sells for its weight in gold?

Ans.—Ginseng is so highly esteemed in China as a medicine that it is sometimes sold for its weight in gold.

E. M. OWENS.

503. How many pounds can be supported by a silver wire $\frac{1}{2}$ of an inch in diameter?

ANS.—A silver wire with a diameter of $\frac{1}{12}$ of an inch is able to support a weight of 188 pounds. E. M. OWENS.

506. Name the chief opium-producing country, and incidents in the history of opium eaters.

ANS.—The cultivation of the *Papaver somniferum* for the sake of opium is carried on in many parts of India, but the chief opium district is a large tract on the Ganges, about 600 miles in length and 200 miles in breadth.

Incidents in the history of opium eaters are hard to give because we do not know what kind of incidents are wanted. J. H. W. SCHMIDT.

507. What president of the U. S. never issued an annual message? Why?

ANS.—The first president that issued an annual message was Jefferson. Previous to this the president had always met the two houses on their assembling, and had addressed them in person. Harrison never issued an annual message, because he died just one month after his inauguration. JNO. H. KNEISLY.

508. Will the needle of the compass reverse its position if carried from North to South Latitude?

ANS.—It will not reverse its position, for a common compass needle must be loaded at both ends to keep it horizontal. "Like effects are commonly attributed to like causes." If a magnetic needle freely suspended is carried to different parts of the earth's surface it will dip as it approaches the polar regions, and is only horizontal at or near the earth's equator.

In the year 1831 a point was found on the western coast of Boothia by Sir Thomas Ross where the dipping needle lacked only $\frac{1}{10}$ of pointing directly to the earth's center. A point was found by the same voyager in Victoria Land, where the opposite pole of the needle lacked only $1^{\circ} 20'$ of pointing to the earth's center. J. HERSHEY.

509. In reduction of circulates why do we use as many 9's as there are figures in the repetend?

ANS.—Removing the decimal point one place to the right, multiplies the repetend by 10; two places, by 100, and so on. Then getting 100 times the repetend, and subtract once the repetend from it, it will give 99 times the repetend; therefore once the repetend is equal to the number divided by 99. E. R.

510. Who is the author of

"How small, of all that human hearts endure,
That part, which kings and laws can cause or cure,"

and where can it be found?

ANS.—Samuel Johnson. See lines added to Goldsmith's *Deserted Village*. WILLIAM HOOVER.

CREDITS.

GEO. H. THOMAS, *German, Ohio*, 493, 496, 508.

W. W. WOODS, *Versailles, Ohio*, 472, 473.

JOS. T. HERSHEY, *Gettysburg, Ohio*, 495, 496, 503.

JNO. H. KNEISLY, *Gettysburg*, 495, 496.

WM. S. DAVIDSON, *Pyrmont, Ohio*, 495.

E. M. OWENS, *German, Ohio*, 493, 496, 501.

J. E. FELLEBS, *La Belle, Mo.*, 495, 496.

THOS. BRAWLEY, *New Madison, Ohio*, 496, 503.

MATTIE HARLEMAN, *Gordon, Ohio*, 477.

A. F. PRAKEL, *Versailles, Ohio*, 477.

J. H. W. SCHMIDT, *Columbus, (Capital University), Ohio*, 493, 496.

QUERIES.

547. Whence come the oft-quoted lines:—

"Though the mills of God grind slowly, yet they grind exceedingly small."

"The power behind the throne."

"To sow one's wild oats."

And what do they severally mean?

C. H.

548. How many called sessions of Congress have been held? Give dates and causes.

Id.

549. Who is meant in Whittier's *Snow Bound* by "Siena's Saint" and the "Crazy Queen of Lebanon"?

Id.

550. Name and locate all the historical trees in the U. S.

Id.

551. Why did the French in Canada extend their explorations westward to the Mississippi rather than southward into New York?

ED. RYNE.

552. In what battle did both generals mass their strength on the left wing, expecting to crush the enemy's right?

Id.

553. Who is the author of the familiar lines,

Thirty days hath September, etc.

T. J. UPDYKE.

554. Who is the originator of the "Theory of Limits"?

Id.

555. Please state Prop. 5, Book I. of Euclid, known as the "Pons Asinorum."

Id.

556. Who is president of Oxford College?

J. E. FELLERS.

557. Name all the congressmen from Ohio.

Id.

558. Are James and Harry Garfield attending school now, and if so, where?

Id.

559. What public school in the United States supports the greatest number of teachers?

Id.

560. Name the portraits on the several denominations of U. S. postage stamps.

WM. S. DAVIDSON.

561. Tell what circular numbers are.

Id.

562. State why the Amazon River, Catskill Mts., Little Rock, Crown Point and Patagonia were so named.

Id.

563. Give author of the speech named, "Mausoleum of Hearts."

Id.

564. Define isoclinal, isogonic and isothermal lines.

Id.

565. What state pays its governor the highest salary?

GEO. L. SHANER.

566. Name the "City of the Violet Crown."

Id.

567. Give a sketch of the poet called the "Etrick Shepherd."

Id.

568. State the provisions of the Nicaragua Treaty, of Nov. 1884.

COSMOS.

569. Is there a canal across the Isthmus of Panama? of Tehuantepec?

Id.

570. It has been computed by ancient astronomers that the obliquity of the earth's ecliptic has been decreasing for 20,000 years, and will continue to decrease a number of years longer; after this it will begin to increase and return to its former position. How long will it be? S. G. C.

571. Who was Leggett? and where is his monument? G. P.

572. State the loss sustained by both armies in the battle of Trenton, Dec. 25, 1777. Id.

573. Whittier's poem, *Massachusetts to Virginia*, was written on reading an account of the proceedings of the citizens of Norfolk, Va., in reference to George Latimer, the alleged fugitive slave, etc. Give said proceedings, and give, also, the incidents pertaining to the negro Somerset, of England, in 1772, mentioned in a foot-note to the same poem. Id.

574. Are persons so organized by nature that they instinctively take a vicious course? M. C. MYERS.

575. What Lord Mayor of London, in the 14th century, was noted as a public benefactor, and who got his start in business life by the sale of his extraordinary cat? Give incident. Id.

576. Give the author of the following expressions: (a) "Young man, your discourse resembles the Cypress, which is tall and spreading, but bears no fruit," and (b) "And for my part I will make this a happy day for the Romans." VAL. HARTMAN.

577. Give a brief sketch of the "Jetty System."

W. H. HAMILTON.

BOOK NOTICES.

THEORETICAL AND PRACTICAL BOOKKEEPING, for use in Business Colleges, and in Common Schools, High Schools and Academies, and for Self Instruction. Published by the authors, Williams and Rogers, Rochester, N. Y. Prices to teachers: Introductory, 100 pp., 75 cts.; Bookkeeping, 160 pp., \$1.10; Complete Bookkeeping, 208 pp., \$1.35. Retail prices, \$1.25, \$2.00 and \$2.50, respectively.

Here is one of the best text-books on the subject with which we are acquainted. The complete edition contains all that is found in the other two, and embraces all the principal forms of double-entry bookkeeping. The explicit instructions given for performing the pupil's work, taken in connection with the full illustrative examples which accompany them, make the book practically self-teaching. Not only is the teacher relieved of a great amount of unnecessary labor, but the pupil is inspired with confidence and becomes more self-reliant. The authors are the teachers and managers of the Rochester Business University, and have embodied in this work the most approved methods of instruction, fully explaining every step to be taken and placing such explanation in connection with the transaction. It contains over forty pages of finely engraved penmanship, thus placing before the pupil the most beautifully written forms to imitate and for the cultivation of his taste and judgment. The book has received the highest commendation wherever it has found its way, and we do not hesitate to pronounce it first-class in all respects. Send to the publishers for circulars and further details.



EDITED BY

JOHN S. ROYER.

VOL. VI.

FEBRUARY & MARCH, 1885.

Nos. 2 & 3.

SOLUTIONS OF PROBLEMS.

672. A globe radius a rests on a horizontal plane, distance b from a candle whose height above the plane is c , to determine the area and diameters of the elliptical shadow of globe on the plane.

By A. F. PARSONS, Arroyo Grande, Cal.

Let the figure ABE represent a vertical section through the luminous point A and the center of the globe O resting on the plane at S' , AD' and AE being tangent to circle O at S and C . $OS=a$, $BS'=b$, and $AB=c$. Then ED will be the major axis and H the focus of the ellipse.



Let $\angle HAB = \theta$ and $\angle HAD = HAE = \varphi$. By right triangles

$$AO = \sqrt{[b^2 + (c-a)^2]}, \quad AS = \sqrt{(b^2 + c^2 - 2ac)},$$

$$AH = c \div (c-a) \sqrt{[b^2 + (c-a)^2]}.$$

$$\tan \theta = b \div (c-a), \quad \tan \varphi = a \div \sqrt{(b^2 + c^2 - 2ac)},$$

$$\text{and } ED = c \tan(\theta + \varphi) - c \tan(\theta - \varphi) = c \{ \tan(\theta + \varphi) - \tan(\theta - \varphi) \}$$

$$c \sin 2\theta \div \cos(\theta + \varphi) \cos(\theta - \varphi) = \frac{2ac \sqrt{(b^2 + c^2 - 2ac)} [b^2 + (c-a)^2]}{(c-a)^2 (b^2 + c^2 - 2ac) - a^2 b^2}.$$

The latus rectum of the ellipse passes through H and is $\perp$ to ED , and therefore equals $2AH \tan \varphi$, or $2ac \div (c-a)$. The minor axis is

$$(2ED \times AH \tan \varphi)^{\frac{1}{2}} = 2ac \left\{ \frac{\sqrt{(b^2 + c^2 - 2ac)} [b^2 + (c-a)^2]}{(c-a)^3 (b^2 + c^2 - 2ac) - (c-a)a^2 b^2} \right\}$$

$$(2ED)^{\frac{3}{2}} \sqrt{(AH \tan \varphi)^{\frac{1}{4}} \pi} = \frac{2a}{\sqrt{(c-a)}} \left\{ \frac{c \sqrt{(b^2 + c^2 - 2ac)} [b^2 + (c-a)]}{c^3 - 4ac^2 + c(5a^2 + b^2) - (2ab^2 + 2a^3)} \right\} =$$

required area. Make $a=7$, $b=20$, $c=22$, then $ED=42$, latus rectum $=20\frac{8}{15}$, minor axis $=29.367$ and the area is 968.11.

Solved by A. L. FOOTE, Hempstead, New York.

673. Supposing the earth to be a sphere, 7912 miles in diameter. What distance must one travel a place on the meridian of Washington (77°), in latitude 40° N., to another on the meridian of Greenwich, latitude 50° N.?

By WM. WILEY, 86 Jefferson Ave., Detroit, Mich.

In the spherical triangle PGW , let P be the North Pole, G the point on meridian of Greenwich, and W on that of Washington. The angle $GPW=77^\circ$, $PG=40^\circ$, and $PW=50^\circ$. Draw GI perpendicular to PW . Then $R\cos 77^\circ = \cot 40^\circ \tan PI = 10^\circ 41' 21''$, leaving $WI=39^\circ 18' 39''$. Then

$$\sin 39^\circ 18' 39'' : \sin 10^\circ 41' 21'' :: \tan 77^\circ : \tan PWG = 51^\circ 44' 33''.$$

Also, $\sin 51^\circ 44' 33'' : \sin 40^\circ :: \sin 77^\circ : GW = 52^\circ 54' 10'' = 190450''$. $360^\circ = 129600''$, and $GW = (7912\pi \times 190450) \div 129600 = 3652.68$ mi.

Messrs. Foote, Gunder, Cagwin and Parsons solved it.

674. How many hats at \$2, coats at \$4 and trousers at \$10 each, must I buy to have 115 articles worth \$690?

By PROF. H. A. WOOD, 204 East 51st Street, New York.

We have $690 \div 115 = 6$, average price of the articles. In the above operation, it will readily be seen how columns A and B are formed by Alligation. The sum of column A is 2, and of B 3. The problem admits of as many integral results as multiples can be formed of 2 and 3 whose sums respectively, are 115. To find these multiples we begin by taking one of the numbers, successively, from 115 until the remainder is divisible by the other number. This remainder is the multiple of the other number, and the first number, multiplied by the number of times subtracted is the corresponding multiple of the first number. Continuing the operation will give all the multiples. By employing this process we obtain the following 18 results:

Hats, 56 53 50 47 44 41 38 35 32 29 26 23 20 17 14 11 8 5
Coats, 2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62 66 70
Trousers, 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40

By JOHN C. GREGG, A. M., Brazil, Ind.

Let x =No. of hats, y =coats and z =trousers. Then $x+y+z=115 \dots (1)$ and $2x+4y+10z=690 \dots (2)$. Divide (2) by 2; and subtract (1) from result, $y+4z=230 \dots (3)$. Now y and z may have any values that will satisfy equation (3). If $y=2$, $z=57$ and $x=56$. If $y=6$, $z=56$ and $x=53$. If $y=10$, $z=55$ and $x=50$. If $y=14$, $z=54$ and $x=47$.

Mr. Gregg gives hats 2, coats 74 and trousers 39, in addition to Prof. Wood's answers. Solved by Messrs. Foote, Parsons, Cagwin, Watson and Wiley.

675. A cylindrical vessel open at the top is made of material of density d . The inside depth and radius are h , and r ; thickness t . How much liquid of density s must be poured in that the center of gravity of vessel and liquid may be the lowest possible?

By WILLIAM HOOVER, *Athens, Ohio.*

The capacity of the vessel is πhr^2 , the volume of the mass excluding the base is $\pi h[(r+t)^2 - r^2]$, that of the base is $\pi t(r+t)^2$. Let x = the required depth of liquid, and x = the distance of the center of gravity required from the center of the base of the vessel. Taking moments about the latter point,

$$x[\pi r^2 s x + \pi h d \{ (r+t)^2 - r^2 \} + \pi d t (r+t)^2] = \pi r^2 s x (t + \frac{1}{2}x) + \pi d h \{ (r+t)^2 - r^2 \} (t + \frac{1}{2}h) + \frac{1}{2} \pi d t^2 (r+t)^2 \dots (1)$$

Placing the last three terms within the bracket = $\pi r^2 s m$, and the last two of the right member = $\pi r^2 s n$, we have from (1),

$$x = [x(t + \frac{1}{2}x) + m] \div (x + n) = \text{a maximum} \dots (2).$$

Differentiating (2), and equating the first differential coefficient to zero, we have

$$x^2 + 2nx = 2m - 2nt, \text{ whence } x = \sqrt{(n^2 - 2nt + 2m)} - n.$$

676 By the EDITOR.—A sphere weighs 4 lb. in air and 1.9056 lb. in water; find its diameter.

By PROF. COOPER D. SCHMITT, *Charlottesville, Va.*

The weight of the water displaced is $4 - 1.9056 = 2.0944$ lb. A cubic foot of water weighs 62.5 lbs, hence the volume of the water displaced is $\frac{2.0944}{62.5}$ cu. ft., which is also the volume of the sphere, as a solid immersed displaces its own bulk of water. Then

$$\frac{4}{3} \pi (\frac{d}{2})^3 = \frac{2.0944}{62.5} \div .5236 = \frac{2}{5} \text{ of a foot or } 4.8 \text{ in., the diameter of sphere.}$$

Solved similarly by J. R. Baldwin, G. W. Leahy, H. Gunder, Alex. Knisely, Wm. Wiley, S. G. Cagwin, Lewis McKibben, J. M. White, Geo. C. Russell and A. F. Parsons.

677 By the EDITOR.—When the sun's upper limb is 30° above the horizon, a yard-stick is so held as to cast its longest shadow. Required, the inclination of stick and length of shadow.

By J. R. BALDWIN, *Blue Grass, Iowa.*

Let C be the position of the upper limb of the sun, and E the foot of the stick. It is evident that the shadow will be longest when ED is perpendicular to BC . But the $\angle ABC = 30^\circ$; then the $\angle BED = 90^\circ - 30^\circ = 60^\circ$. Then $DE : \sin 30^\circ :: EB : R$,

Or $1 : \frac{1}{2} :: EB : 1$, whence $EB = 2$ yds., length of shadow.



By A. F. PARSONS, Arroyo Grande, Cal.

The cane to cast a shadow of maximum length must be placed perpendicular to the rays of light. The limit of total shade will be at the point of intersection with the horizontal plane of the tangent from the sun's upper limb. For this the inclination will be $90^\circ - 30^\circ = 60^\circ$ and the length of shadow $3 \sec 60^\circ = 6$ ft. The limit of partial shadow will be at the point of intersection of tangent from the sun's lower limb. The inclination is $90^\circ - 29^\circ 28' = 60^\circ 32'$ and the length of shadow $3 \sec 60^\circ 32' = 6.09858$ ft.

Messrs. Scripture, Wood, Harvey, White, Wiley, Gunder and Cagwin solved it similarly.

678 *By Request.*—Find seven numbers, each of which is equal to the sum of all its divisors including 1.

By PROF. H. A. WOOD, 204 East 51st Street, New York.

The numbers which are equal to the sum of all their divisors including 1 are called Perfect Numbers; take the geometrical series 2, 4, 8, 16, 32, 64, &c., and find those numbers which, when diminished by unity, are prime numbers. These are 4, 8, 32, 128, 8192, &c., which being diminished by unity, are 3, 7, 31, 127, 8191, &c. Multiply each of these numbers by that number in the geometrical series which precedes the one from which it is deduced; as, 3 by 2, 7 by 4, 31 by 16, 127 by 64, 8191 by 4096, &c., and the results give the Perfect Numbers, the first seven of which are 6, 28, 496, 8128, 33550336, 8589869056, and 137438691328. To these may be added an eighth 2305843008139952128. The rarity of these numbers says an author is a symbol of perfection. These numbers all terminate with 6 or 28. The difficulty of finding perfect numbers consists in finding primes of the form $2^n - 1$. When this expression is prime we may write the formula

$$2^n - 1 (2^n - 1) = \text{a perfect number.}$$

2147483647 is the highest prime number known, which Barlow remarks is probably the highest that will ever be discovered. Two other numbers have been given by an author as perfect numbers, which have been copied into other works,—these are

2417851639228158837784576 and 9903520314282971830448816128.

Scripture, Gunder, Wiley, Baldwin, Parsons and Reed gave good solutions.

679 *By Request.* Required the kind of glasses and their focal length, which a short-sighted person must wear to see 20 feet, if he can see distinctly 4 feet.

By the Editor.

Having no solution to this problem from contributors, we deduce the following from a mathematical discussion of *Vision through a Lens*, pp. 187-191, Parkinson's Optics. Let x = the focal length of a double concave lens, $v = 4$ feet, the distance of distinct vision, and $u = 20$ feet, the distance of the object to be focalized. Then by the formula, p. 189 of the above-named treatise, we have

$$\frac{1}{v} = \frac{1}{x} + \frac{1}{u}, \text{ whence } x = \frac{uv}{u-v} = (20 \times 4) \div (20 - 4) = 5 \text{ feet.}$$

That is, the focus of the lens must be 5 feet from its center.

680. *By W. J. MOSELEY, Winnfield, La.*—Two poles standing on a plane 30 feet apart, are 50 feet and 75 feet in height. Where must the highest break so that its top may just reach the top of the other?

By HON. JOSIAH H. DRUMMOND, Portland, Me.

Let x = height from ground tree breaks; and $75 - x$ = length of tree broken part; and when it leans over we have a right-angled triangle whose sides are $75 - x$, 30 and $50 - x$; and $(50 - x)^2 + 900 = (75 - x)^2$; $x = 44\frac{1}{2}$.

Elegant solutions furnished by the following distinguished contributors:

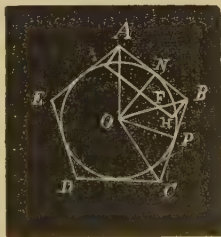
A. F. PARSONS, <i>Arroyo Grande, Cal.</i>	PROF. H. A. WOOD, <i>New York City,</i>
S. G. CAGWIN, <i>New London, N. Y.</i>	COOPER D. SCHMITT, <i>Charlottesville, Va.</i>
HENRY GUNDER, <i>New Castle, Ind.</i>	DR. S. P. BARTLETT, <i>East Dixfield, Me.</i>
L. A. REED, <i>Cleveland, Ohio,</i>	WM. WILEY, <i>Detroit, Mich.</i>
LEWIS MCKIBBEN, <i>Springfield, Ohio,</i>	J. M. WHITE, <i>Burlington Junction, Mo.</i>
L. M. SCRIPTURE, <i>Clinton, N. Y.</i>	J. R. BALDWIN, <i>Blue Grass, Iowa,</i>
ALEX. KNISELY, <i>Columbia City, Ind.</i>	W. L. HARVEY, <i>Maxfield, Me.</i>
GEO. W. LEAHY, <i>Marshallville, Ohio,</i>	PROF. GEO. C. RUSSELL, <i>Woodland, Cal.</i>
J. W. JONES, <i>Circleville, Ohio,</i>	

681. *By the same.*—How much dressed lumber 12 feet long, 6 inches wide and 2 inches thick must I buy to curb a well 32 inches in circumference and 36 feet deep, and how much must be beveled from each edge so that the planks may just fit?

By A. M. SCRIPTURE, Clinton, N. Y.

It is evident from inspection that five planks will be very nearly the right size. Let O be the center of the well, $OA = \frac{1}{2}(32 \div \pi) = 5.0929$ radius of well; $360 \div 5 = 72^\circ$, arc covered by a plank; $\frac{1}{2}$ of angle $AOB =$ angle $BON = 36^\circ$; chord $72^\circ = AB = 2(R \sin 36^\circ) = 5.98726$. $\therefore$ a plank will be too wide by .01274 inch. Having removed thin shaving, it will be necessary

to bevel the edges equal to the right triangle BHF . Since angle $BON = 36^\circ$, $OBN = 90^\circ - 36^\circ = 54^\circ$. By similar triangles, $FBH = 36^\circ$,



and $BFH=54^\circ$; $BH=2$ inches, and by trigonometry

$$\sin 54^\circ : \sin 36^\circ :: 2 \text{ in.} : BF = 1.453 \text{ in.}$$

It requires 15 planks, or $[(6 \times 2 \times 12) \div 12] \times 15 = 180$ feet of lumber.

By A. F. PARSONS, Arroyo Grande, Cal.

1. If the curb be a pentagon. The radius of well is 5.093 in. The chord of 72° in a circle of this radius is 5.9872 in. The radius of well at inner angle is $5.093 - 2 \sec 36^\circ = 2.621$ in., and the chord of 72° to this radius is 3.0812; hence the boards will be beveled on the line drawn $\frac{1}{2}(6 - 5.9872) = .0064$ in. from the back corner to a point $\frac{1}{2}(6 - 3.0812) = 1.4594$ in. from front corner. The lumber used is $(2 \times 3 \times 6 \times 12 \times 5) \div 12 = 180$ feet.

2. If for a square. The distance of middle point of outer plank from center of well is $(R^2 - 3^2) = 4.115$ inches, and distance from the center to middle of inner side is $4.115 - 2 = 2.115$ inches. Then $3 - 2.115 = .885$ in., and the bevel line is drawn to points on the sides and edges of the planks .885 inches from each inner corner. The lumber required is $(2 \times 3 \times 6 \times 12 \times 4) \div 12 = 144$ feet.

Good solutions received from Messrs Drummond, Gunder, Cagwin, Sublette, Harvey, and White.

682, *By J. W. JONES, Circleville, Ohio.*—I employed an agent to sell goods at \$69 per month. I started him with cash \$58 and goods valued at \$59.50. During the month he bought \$281.55 worth of goods and sold \$293.85 worth. At the end of the month he returned \$81 worth of goods unsold. How much does he owe me, and what do I lose beside?

By HON. JOSIAH H. DRUMMOND, Portland, Me.

The agent had \$58 and the amount of his sales was \$293.85; as he returned the goods not sold, he owes $\$58 + \$59.50 + \$293.85 - \$69 = \$282.85$. The principal was out $\$58 + \$59.50 + \$281.55 - \$81 = \$318.05$; then $\$318.05 - \$282.85 = \$35.20$, loss; provided the agent pays what he owes.

By ALEX. KNISELY, Columbia City, Ind.

The agent receives \$59.50 worth of goods and purchased \$281.55, making \$341.05, and returns \$81 worth, leaving \$260.05 worth sold for \$293.85 and gaining \$33.80 by sales. Then agent should be charged with $\$58 + \$33.80 + \$59.50 = \151.30 , and credited for \$81 worth of goods returned and \$69 salary, or \$150 is the amount of his credits, and \$1.30 is yet due from agent, less. $58 + \$59.50 = \117.50 , received by agent, less \$81, goods returned, gives \$36.50 loss; but if the agent pays what he owes, the loss is $\$36.50 - \$1.30 = \$35.20$.

L. A. Reed, J. M. White, G. W. Leahy, H. A. Wood, A. F. Parsons solved it.

683. By PROF. H. A. WOOD, 204 E. 51st. St., N. Y.—The fore wheel of a wagon in running 120 yards, will turn 6 times more than the hind wheel, but add a yard to the circumference of each and it will turn but five times more. What is the circumference of each?

By J. M. WHITE, Burlington Junction, Mo.

Let x = the circumference of the hind wheel and y = that of the fore wheel in yards. Then we have

$$\frac{120}{y} - \frac{120}{x} = 6 \dots (1), \text{ and } \frac{120}{y+1} - \frac{120}{x+1} = 5 \dots (2).$$

Clearing both of fractions reducing and subtracting (1) from (2), we have $3x - 5y = 1$, or $y = \frac{1}{5}(3x - 1) \dots (3)$. Substituting this value of y in (1), and reducing, $3x^2 - 41x = 20 \dots (4)$, whence $x = 14.1382$ yards, and $y = 8.2829$ yards.

L. A. Reed, Alex. Knisely, H. L. Harvey, A. L. Foote, S. G. Cagwin, A. F. Parsons, J. R. Baldwin, Wm. Wiley, A. G. GUNDER, Cooper D. Schmidt, J. H. Drummond, Lewis McKibben and the Proposer gave good solutions. Lewis McKibben, of Springfield, Ohio, observes that if the problem read *four times more* in stead of "five times more," the answers would be $\frac{1}{4}$ and $\frac{1}{5}$ yards respectively.

684. By the same.—An army 25 miles long marches 25 miles. At the moment of starting a courier is despatched from the rear, who rides to the front of the column, turns and reaches the last man just as he has completed the 25 miles. How many miles did the courier ride?

By WM. WILEY, Detroit, Mich.

Put $a = 25$, let x = distance army moves, while the courier goes to the front, his distance being $a + x$. After that the army goes $2a - (a + x) = a - x$. In the same time the courier goes in the opposite direction $a + x - a = x$. Hence

$$a - x : x :: x : a + x, \text{ and } x^2 = a^2 - x^2, \text{ or } 2x^2 = a^2, \text{ or } x = a\sqrt{\frac{1}{2}}.$$

The whole distance the courier rides is $2(a + x) - a = a + 2x = a(1 + \sqrt{2}) = 25(1 + \sqrt{2}) = 60.3553$ miles.

By A. F. PARSONS, Arroyo Grande, Cal.

1. Let x = rate per hour of courier and a = rate per hour of army. In $25 \div (x - a)$ hours the courier reaches the head of the army, and then in $25 \div (x + a)$ hours he reaches the rear; but we have

$$\frac{25}{x-a} + \frac{25}{x+a} = \frac{25}{a} \dots (1),$$

which reduces to $x^2 - 2ax = a^2 \dots (2)$, whence $x = a(1 + \sqrt{2})$. The distance he travels is $25x \div a = 25(1 + \sqrt{2}) = 60.3553$ miles.

2. In the straight line AC , take B so that $AB = BC$. Let AB represent the position of army at the beginning of the courier's journey and BC its position at the end. The courier will reach the head of

the army at some point as D , and let $BD=x$. As the rates of both army and courier are uniform, we have

$$AD : BD :: BD : CD, \text{ or } 25+x : x :: x : 25-x,$$

whence $x^2=625-x^2$, or $x=\sqrt{312.5}$. The courier travels $25+2x=60.3553$ miles.

685. By DR. S. P. BARTLETT, *E. Dixfield, Me.*—Find x and y from the equations, $x^2y+x=xy+x^2y^2-4y+4\dots(1)$, and $xy+1=3xy^2-x^2y^3\dots(2)$

By HENRY GUNDER, *New Castle, Ind.*

Divide (1) by $1-y$ and we have $x^2y+x=4\dots(3)$. Now $(2)\times x=3$, or $4=3x^2y^2-x^3y^3\dots(4)$. The values of xy in (4) are -1 , 2 and 2 . Putting $xy=2$ in (3), we get $x=1\frac{1}{3}$, $1\frac{1}{3}$. Putting $xy=-1$ in (4), $x^2y^2(3+1)=4$, or $xy=\pm 1$, but $xy=-1$ has been used; hence $xy=+1$ in (3), gives $x=2$ and $y=\frac{1}{2}$. From $x=1\frac{1}{3}$, $y=1\frac{1}{2}$, $1\frac{1}{2}$. $\therefore$ the values are $x=1\frac{1}{3}$, $1\frac{1}{3}$, 2 , and $y=1\frac{1}{2}$, $1\frac{1}{2}$, $\frac{1}{2}$.

By L. A. REED, *Cleveland, Ohio*

Put $xy=m$, and $x=m\div y$, which, substituted in the equations given, we have

$$m^2+m=my+m^2y-4y^2+4y\dots(3)$$

and

$$m+1=3my-m^2y\dots(4)$$

equation (3) may be written

$$m(y-1)(m+1)=4y(y-1)$$

or

$$y=\frac{1}{4}m(m+1).$$

From equation (4), $y=(m+1)\div(3m-m^2)$.

Hence

$$\frac{m(m+1)}{4}=\frac{m+1}{3m-m^2},$$

or $m^3-3m^2+4=0$, whence $m=-1$ or $+2$.

Substituting the value $+2$ for m , we have $x=1\frac{1}{3}$ and $y=1\frac{1}{2}$, the required values.

Solved by Profs. Wood and Schmitt.

686. By W. C. BINKLEY, *Cincinnati, Ohio.*—A hawk and a dove are in the air, the hawk 150 feet above the dove. If the dove flies straight forward in a horizontal line, and the hawk flying $1\frac{1}{4}$ times as fast directly towards the dove, how far will the hawk fly till it catches the dove?

By PROF. H. A. WOOD, *204 East 51st Street, New York.*

The track of the hawk is known as the "curve of pursuit." Excellent solutions of this curve will be found in the *Visitor*, for Nov. 1883, by the late Prof. Seitz and others.

If x =distance the dove flies, and the hawk flies m times as fast, then mx =distance the hawk flies. With these conditions Wm. Wiley,

in the *Visitor* referred to, gives a very simple formula, for reduction. His formula deduced from the Calculus, and applied to this problem, gives

$$x = 150 \left(\frac{m}{m^2 - 1} \right).$$

If $m = 1\frac{1}{4}$, $x = 333\frac{1}{3}$ ft., and $mx = 416\frac{2}{3}$ ft.

By J. W. JONES, *Circleville, Ohio.*

The ratio of flight is 4 to 5; and we have

$$(5-4) : 150 :: 5 : 750 \text{ feet distance both flew;}$$

and $(5+4) : 750 :: 5 : 416\frac{2}{3}$ feet, distance eagle flew;

$$(5+4) : 750 :: 4 : 333\frac{1}{3} \text{ feet, distance dove flew.}$$

Elaborate solutions were furnished by J. R. Baldwin, Blue Grass, Iowa, and P. M. McKay, of Alma, Ark., but as solutions to which Prof. Wood refers are complete, we do not deem it expedient to take up the space here. Messrs. Gun-der, Wiley, Cagwin and Parsons solved Prob. 686.

687. By WM. WILEY, *Detroit, Mich.*—A shore AB trends due east in the direction $AB=5$ miles. There is a boat at C , 3 miles south of A . A man in the boat can row 4 mi. an hr., and he can walk 5 miles per hour. What course will he take to reach B the quickest?

By A. L. FOOTE, *Hempstead, L. I.*

It is evident that he can row to a certain point in the shore from C and then walk to B , quicker than he can row direct to B or walk from C to A and thence to B .

Let D be the point in AB to which he rows, and let $AD=x$, and $BD=5-x$; then we have the distance $CD=\sqrt{(9+x^2)}$; time to row $CD=\frac{1}{4}\sqrt{(9+x^2)}$; and the time to walk $DB=\frac{1}{5}(5-x)$. Therefore

$$\frac{1}{4}\sqrt{(9+x^2)} + \frac{1}{5}(5-x) = \text{a minimum. Differentiating } \frac{xdx}{4\sqrt{(9+x^2)}} - \frac{dx}{5} = 0$$

and $5x=4\sqrt{(9+x^2)}$, or $25x^2=144+16x^2$; whence $x=4$. Therefore he strikes the shore four miles from A and then walks one mile to B , requiring for the whole journey 1 hr. 27 min.

Solved by Mesers. Parsons, Reed, Russell, Drummond, Schmitt, Leahy, Gun-der, Cagwin, Proposer and G. W. Sublette. The latter gave the course of the boat from C , which is N. $53^\circ 7' E$.

NOTE.—The publication of D. H. Davison's admirable method of inscribing circles, is deferred for a future issue, in order to procure engravings, etc., to give the method with illustrations complete. S. G. Cagwin solved problem 664 and A. L. Foote solved Nos. 676 and 677. A solution of No. 243, without trigometrical functions, is called for. Solution by Mr. Seitz in Oct. No., 1881. We will publish Thompson's approximate solution in April.

Problems for Solution.

704. *By B. F. FINKEL, Commercial Point, O.*—A man digging a well 3 feet in diameter came to a log 3 feet in diameter, lying across the entire well; find solidity of part the log removed.

705. *By GEO. L. SHANER, Stewarts Station, Pa.*—A garden in the form of a rectangle, 128 by 112 feet, has a walk around it within the border, 4 feet in width, and two walks each 3 feet wide crossing each other in the center and extending to outer walk; what is the area of the garden not occupied by walks?

706. *By H. A. WOOD, New York.*—If A tells the truth 3 times out of 4; B, 4 times out of 5; and C, 5 times out of 6; what is the probability of an event that A and B assert and C denies?

707. *By the same.*—If a ball is let fall from a height of 400 feet, and at the end of 3 seconds another is fired upwards with a velocity of 100 feet per second; where will the balls meet?

708. *By the same.*—A circular field is inclosed by a fence with rails 15 ft. long and 6 rails high. If there are 24 times as many rails in the fence as acres in the field, how many acres does it contain?

709. *By N. R. OLIVER, Dorchester, Ont.*—Given $x^2y + y^2x = 304392$ and $x^2y - y^2x = 6600$, to find x and y by a simple equation and without substitution.

710. *By DR. N. R. OLIVER.*

A, B and C meeting once betimes, and it being noon they did agree,
The two who had the fewest dimes should have their dinner free
And the one who had dimes the most, should for their dinners pay the host.
Now, when they counted it was found that B had twice as many dimes
As A, which made him look profound and count them over three times;
And, B comparing his with C, found C had twice as many as he.
Then C for their dinners had to pay, which was 20 dimes for three,
And said he would do it every day, till their dinners should even be,
When all theirs then, when put together, would buy 3 eagles of no feather.
Now tell me all who can and try, how many eagles would all this money buy.

711. *By ED. RYNEARSON, Gettysburg, Ohio.*—A general drew up his brigade in the form of a square and had one man left over; but receiving a re-enforcement of 423 men, he was able to increase the side of the square by 4 men; how many men had he at first?

712. *By Request.*—Two cog wheels, one having 42 cogs and the other 30 cogs, run together; in how many revolutions of the smaller wheel will it gain 16 revolutions?

713. *By Request.*—The perimeter of a piece of land in the form of an equilateral triangle is 624 rods; find its area.

714. *By Request.*—I have a squared log twice as long as wide or deep, and make a trough out of it, leaving 2 inches at sides, ends and bottom; the solidity of the wood left in trough is 2216 cu. in. How many gallons does the trough hold?

715. *By the Editor.*—A gravel walk is to be made half round a rectangular garden 100 feet long and 80 feet wide; what must be the width of walk so as to take up half the area of the garden?

716. *By Request.*—A has a garden in the form of an equilateral triangle. From the corners to a spring within the garden, the distances are $a=20$, $b=28$ and $c=31$ rods. Find side of the garden.

717. *By Request.*—How long before due must a bank discount a note at 6% in order to receive for its money a discount equal to 10% interest?

Solutions should be received on or before April 10.

Editorial Notes.

ERRATA.—In W. L. Harvey's Solution of Prob. 660, p. 4, between 4th and 5th line, insert —Let $m = 10$; then the horse must graze one- m th of the field. Also in the equation following (B),

$$(1-m)\pi \div 2m - \sec 2z \text{ should be } (1-m)\pi \sec 2z \div 2m.$$

Please write with ink along margin of H. A. Wood's solution of Prob. 674, p. 26 of this issue, the following operation which was inadvertently omitted:

$$6 \left\{ \begin{array}{c|c|c|c|c|c|c|c} 2 & \frac{1}{4} & 1 & 56 & 56 \\ 4 & \frac{1}{2} & 2 & 2 & 2 \\ 10 & \frac{1}{4} & 1 & 1 & 56 & 1 & 57 \end{array} \right\} \text{1st Ans.}$$

$$\begin{array}{cc} 2 & 3 \end{array}$$

Since the last issue the following esteemed friends have furnished clubs for the *Visitor*:

PROF. J. C. CORBIN, *Pine Bluff, Ark.*,
 " A. L. FOOTE, *Hempstead, N. Y.*,
 " COLMAN BANCROFT, *Hiram, Ohio*,
 W. C. MENDENHALL, *West Sonora, Ohio*,
 E. J. McLAUGHLIN, *Canal Fulton, Ohio*,
 HOMER M. KNOWLES, *Milnersville, O.*,
 W. R. ALEXANDER, *Oskaloosa, Kan.*,
 LIZZIE CALHOUN, *New Straitsville, O.*,
 A. F. PARSONS, *Arroyo Grande, Cal.*,
 AARON WRIGHT, *Painter Creek, Ohio*,
 I. E. POLING, *Ansonia, Ohio*,
 M. M. THOMPSON, *Clarksburg, W. Va.*,
 J. A. ROACH, *Red Wing, Minn.*,

WM. SELLERS, *North Star, Ohio*,
 JOHN FITZGERALD, *Greenville, Ohio*,
 GEO. ALEXANDER, *Rose Hill, Ohio*,
 W. L. HALLEY, *Masfield, Me.*,
 T. HESTAND, *Hagerman, Ohio*,
 IRWIN SPENCER, *Totten, Ohio*,
 E. P. CLEMENS, *Spartansburg, Ind.*,
 J. T. PHILLIPS, *Potsdam, Ohio*,
 M. A. BROWN, *German, Ohio*,
 JOS. RUBLE, *Laura, Ohio*,
 A. M. SCRIPTURE, *Clinton, N. Y.*,
 C. F. YOUNG, *Weaverville, Pa.*,
 JOHN OHMERT, *Greenville, Ohio*.

We can still furnish back numbers of this year, as the edition for January is not exhausted, and we printed enough of this issue to equal the surplus. Our friends can add names to their clubs at any time during the year at their former rates. With many thanks for the kind favors from those who appreciate the *Visitor*, we await your further pleasure.

We consider the *Ohio Educational Monthly*, one of the best journals in the country, and of especial value to Ohio teachers. Samuel Findley, its editor and publisher, seems to have a clear conception of what the common school teacher needs in pedagogics, and the pages of the *Monthly* are full of the best thoughts. We have made arrangements to club the *Monthly* with the *School Visitor*, at \$2.25 a year for both, regular price of the former being \$1.50. We hope our teachers will take advantage of this liberal offer, and secure two periodicals that will be of genuine value to them.

The board of examiners in Darke Co. have concluded that candidates for license should take one or more educational periodicals, and the new certificates provide for the proper record. Those who can not afford to pay at least seventy-five cents for their home journal, or $2\frac{1}{4}$ dollars for it and the Ohio Ed. Monthly, hardly possess enough professional zeal to keep them alive. Subscribe for the *Visitor*.

Examination Questions.

NOTE.—First set of questions in each branch was used Feb. 7, and the second set March 7. Most of the questions are easily answered by reference to any text-book, and it is considered unnecessary to take up space for such answers. Feb. 7 the number of applicants was 166, of whom 120 received certificates. March 7, there were 96.

SPELLING.

Potion, accession, sley, optician, spikenard, obliquely, singeing, glad-iolus, lisle-glove, spongy, indelible, trachea, cerement, bifid, omitting, wiseacre, plaguing, aguish, kaleidoscope, maelstrom.

Preceded, pseudonym, precedent, gypsy, truculence, cereal, glycerine, idyl, facetious, cylinder, resuscitate, embroider, faucet, infallible, serge, gneiss, geranium, gentian, pleurisy, descension.

GRAMMAR.

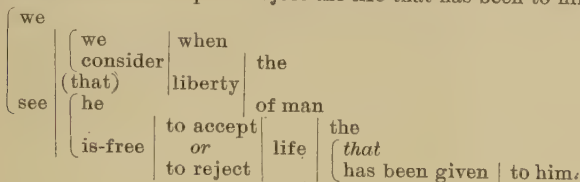
1. What are the syllabic divisions of words?
2. What are the different ways of distinguishing gender? Give examples of each.
3. Give examples illustrating ten case constructions.
4. What parts of speech admit of variation?
5. Illustrate the different uses of *what*.
6. Define:—Auxiliary verb, synopsis, strengthened copula, arrangement, blank verse.
7. Parse italicized words:—*To live in hearts we leave behind* is not to die.—*Campbell*.
8. Write a sentence using a regular, transitive verb in the passive voice, potential mode, past perfect tense, second person, singular number.
Ans.—You should have been excused.
9. Diagram:—I heard the ripple washing in the reeds,
And the wild water lapping on the crags.—*Tennyson*.
Ans.—Washing modifies ripple. Nothing else difficult.
10. Scan the above. What kind of verse is it? Define the terms used.
Ans.—Iambic Pentameter.
1. Define Grammar as a science, as an art, and as a study.
2. Under what four heads is English Grammar treated? Define each.
3. Define *diphthong*, *digraph* and *trigraph*, and give examples of each.
4. Define verbal, abstract, and collective noun, and give examples of each.
5. Write short sentences with *as*, *what* and *that* as relative pronouns.
6. How are verbs divided with respect to form? With respect to use?
7. State the difference between a relative pronoun and a conjunctive adverb.
8. In Misery's darkest cavern *known*
His useful care was *nigh*,
When hopeless *Anguish* pour'd his groan
And lonely Want retired *to die*.
Account for capital letters in the above.

Ans. - Poetry requires a capital at the beginning of each line, and words personified usually begin with a capital.

9. (a) Bring *what* you found. (b) He was anxious *to secure* the position. (c) Commence *reading* on tenth page. Parse words in italics in 8 and 9.

Ans.—*Known* is a perfect participle, and belongs to *cavern*; *nigh* and *when* are adverbs, limiting *was* and *poured*, respectively; *Anguish* is a noun, subject of *poured*; *to die* is an infinitive, with the construction of an adverb, and limits *retired*; *what* is a compound relative; its antecedent part being the object of *bring* and its relative part object of *found*; *to secure* is an infinitive, construction of an adverb, limiting *anxious*; *reading* is a participial noun, object of *commence*.

10. Diagram the following: When we consider the liberty of a man we see that he is free to accept or reject the life that has been given to him.



ARITHMETIC.

1. If .63 gal. of wine cost \$1.47, what will 9-20 gal. cost. By proportion,
Ans., \$1.05
2. Define *corporation* and *usury*.
3. My house is 24 feet wide, the ridge which is in the middle of the roof is 9 feet higher than the side walls, and the eaves project 1 ft. 6 in beyond the sides of the house. How wide is each side of the roof? Ans., 16½ ft.
4. Separate 75,686,967 into three equal factors. Ans., 423, each.
5. What is the present worth of a note for \$675, due in five months, and without interest, money being worth 7 per cent. Ans., \$655.87.
6. What will it cost to plaster a room 40 ft. long, 25 ft. wide, and 12 ft. high, at 15 cents per square yard? Ans., \$42.67.
7. (a) If 8 be added to both terms of the fraction 7-9, will the value of the fraction be increased or diminished? (b) How much? Ans., Increased, $\frac{1}{9}$.
8. A board contains 18 sq. ft. and is six times as long as it is wide. What is the length and width? Ans., width, $\sqrt{3}$; length, $6\sqrt{3}$.
9. Received 6 per cent dividend on factory stock purchased at 25 per cent below par. What per cent did the investment pay? Ans., 8%.
10. Reduce to a common fraction the pure circulate .063492. Ans., $\frac{63492}{999999}$.
1. Define *unit*, *ratio*, *rule*, *problem*. $[280 \times 64 \div (2504 - 1384)] \times 16 = ?$
Ans., 256.
2. A school-boy wrote to his parent that he had paid $\frac{7}{8}$ of $\frac{3}{4}$ of his debts, and still owed \$44; what were his debts? Ans., \$128.
3. Find cost of a blackboard $4\frac{1}{2}$ feet wide around a recitation room 25 by 30 feet, omitting $3\frac{1}{2}$ feet for a door and 3 feet for each of 4 windows, at 47 cents per square yard. Ans., \$22.20¾.
4. If 4 pounds of cheese can be bought with 60 cents when milk is 10 cents a quart, how many pounds should be bought with 36 cents when milk is 8 cents a quart? Ans., 3 lbs.
5. Purchased 50 sheep at \$4 per head. It cost me \$25 to get them to market and 12 died on the way. Sold the rest at \$6; find my gain %. Ans., 1½%

6. Sold 1,000 bu. of rye and invested the proceeds in leather, charging 3 per cent for selling and 4 per cent for buying. My commission amounted to \$84. How much per bu. did I obtain for my rye? *Ans.*, \$1.248.
7. What principal will amount to \$1,981.26 in 5 years, 10 months and 15 days at 9 per cent? *Ans.*, \$1296.
8. Sent my broker \$2,408 with instructions to purchase stock in P. R. R. after deducting his commission. He informed me that he had invested at 75 per cent and charged me $\frac{1}{4}$ per cent brokerage. How many shares, par value \$50, did he purchase? *Ans.*, $(2804 \div .75 \frac{1}{4} \div 50) = 64$ shares.
9. What is the length of the longest inflexible pole that can be contained in a room 15 ft. long, 13 ft. wide and 9 ft. high? *Ans.*, 21.794 feet.
10. How many bbls. of $31\frac{1}{2}$ gal. each, will a cistern 12 ft. deep, the radii of whose bases are respectively 2 ft. and 10 ft., hold? *Ans.*, 370 + bbls.
- Erratum.*—The answer to 5th on preceding page should be $1\frac{1}{3}\%$.

GEOGRAPHY.

1. Define a peninsula. Name one of Asia, two of Europe, and one of North America.
2. Locate Hamburg, Cairo, Mecca, Buffalo and Bahia.
3. Define hemisphere. Name the continents of the Eastern Hemisphere.
4. Give chief city of Brazil? Of Turkey? Of China? Of Michigan?
5. Name five of the principal vegetable productions of the temperate zones.
6. Locate the Danube river.
7. Locate the capital of each of the political divisions of North America.
8. Define a strait. What does the Strait of Gibraltar connect? What does it separate?
9. Give the origin of springs. Describe wells, intermittent springs, salt springs, mineral springs, hot springs.
10. What is the origin of mountains? Describe a mountain system. In what zone are the greatest elevations?
 1. Name the republics of the world.
 2. What foreign powers have dependencies in America?
 3. Name five peninsulas in North America.
 4. How many townships in Darke county. Name them.
 5. What and where is Tegucigalpa? Chelyuskin? Crimea? Banca? London?
 6. Locate five important currents.
 7. What countries of South America have no sea coast?
 8. Give the terminating points of the Grand Divisions of the Western Hemisphere.
 9. By what is the earth divided into the Eastern and Western Hemispheres.
 10. What is the Land and the Water Hemispheres? Locate center of each.

HISTORY.

1. Give the nationality of the first settlers of Virginia, New York, Delaware, Illinois, and Florida.
 2. Compare the character of the settlers of Plymouth and Jamestown.
 3. What was the fate of Huguenot settlement on St. John's river in 1564?
 4. How were the Quakers treated by the early settlers of Massachusetts?
 5. What changes of territory were made at the close of the French and Indian war? What was the extent of the English possessions then?
 6. Mention some of the causes of the American Revolution?
 7. Give the boundaries of U. S. at close of the Revolution? The population?
 8. Give a short account of the troubles with the Indians on the Wabash and Maumee in 1790-95.
 9. What two states were admitted in Madison's administration?
 10. In what is the judicial power of the U. S. vested? How long do the Judges hold their offices?
 1. Name the European exploring nations in our early history.
- Ans.*—England, Spain, France, Holland, and Portugal.

2. Who were the Patroons?

ANS.—They were the owners of large tracts of land in New Netherland [New York], and by virtue of a decree called *Charter of Liberties*, issued by the Dutch West India Co., these patroons governed the colonies they established. This gave rise to the feudal tenure so long sustained in New York.

3. With whom did Massachusetts have religious trouble?

ANS.—Roger Williams, Mrs. Anne Hutchinson and Quakers.

4. Give the government of each colony just before the revolution.

ANS.—Pa., Md., and Del. had proprietary governments; N. H., S. C., N. J., Ga., N. C., Va., N. Y., royal or provincial; Conn., Mass., R. I., charter.

5. Name five wars in our history and tell what treaty terminated each.

ANS.—King William's, treaty of Ryswick; French and Indian, treaty of Paris; Revolutionary, second treaty of Paris; War of 1812, treaty of Ghent; Mexican war, treaty of Guadalupe Hidalgo.

6. How many States had a right to Presidential Electors in 1824?

ANS.—Twenty-four states having 261 electoral votes.

7. What Presidents have died while in office, and who took their places?

ANS.—Harrison, Tyler; Taylor. Fillmore; Lincoln, Johnson; Garfield, Arthur.

8. What accessions of territory have been made to the United States?

ANS.—Louisiana from France in 1809; Florida from Spain in 1819; Texas from Mexico in 1845 and Arizona, Utah, Cal., New Mexico, Nev. from Mexico in 1848.

9. How many members in the House of Representatives? How long does each Congress last? What Congress closed its work this week?

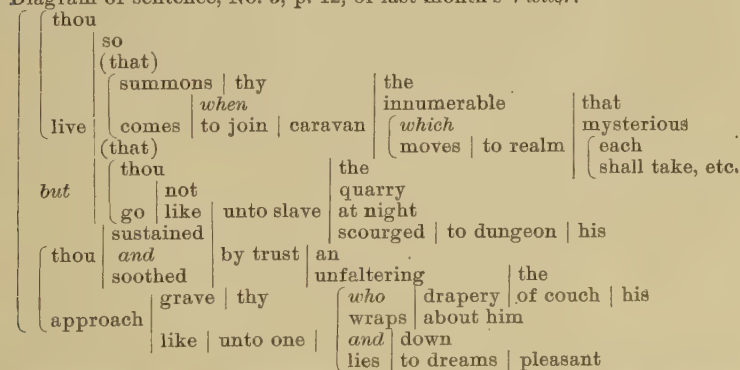
ANS.—325. Two years. 48th.

10. Who invented the cotton gin? Sewing machine? Steamboat? Telegraph?

ANS.—Eli Whitney. Howe. Fulton. S. F. B. Morse.

Note.—We are indebted to Ed. Ryneerson, one of Gettysburg's best historians, for these answers.—*Editor*.

Diagram of sentence, No. 3, p. 12, of last month's *Visitor*.



I would prefer subjunctive mode in parsing *go*, and I am not sufficiently progressive to consider *like* a preposition. J. D. H.

If our learned friend had made the last member of the compound sentence, as he has it, subordinate to *live*, and *to join*, etc., a modifier of *summons*, then we could approve the entire analysis. Though the diagram is not quite as we would make it, yet it is worthy of careful consideration. In the present state of confusion on technical grammar, it can not be expected to have a uniformity of ideas where close discrimination is necessary. A. G. Gunder gave us a good analysis of the sentence; so did Ed. Ryneerson and H. F. Dershem, who also answered query 546. All these differed on a few points.

MISCELLANEOUS DEPARTMENT.

602. *By Request.*—State the different kinds of thermometers, and designate the one recognized by scientists generally.

Ans.—A Swede by the name of Celsius, in 1742, introduced the decimal scale and graduated from the freezing to the boiling points of water. This was adopted in France as the *thermometre centigrade*, and it is known among us as the Centigrade. This thermometer is in highest favor among scientists. It marks blood heat at $36\frac{1}{2}^{\circ}$.

Fahrenheit, born at Dantzic, May 14, 1686, who settled in Holland, conceived the idea, in 1714, of substituting mercury for spirits of wine in the construction of thermometers. He took as zero in his scale the lowest temperature observed by him at Dantzic in 1709, which he found was produced by mixing equal quantities of snow and sal-ammoniac. Between this point and that to which the mercury rose at the temperature of boiling water he divided into 212 parts or degrees. This instrument marks blood heat at 98, and is the most generally used. It is to be regretted that he placed zero 32° below the freezing point. Reaumer's, almost out of use, places bloodheat at $29\frac{1}{3}$, freezing point zero and boiling point 80° .

486. A body occupies 3 cubic feet of space and weighs 150 lb. in air, what will it weigh in a vacuum?

Ans.—I would question the correctness of the published answer to 486, as it is contrary to the "Principle of Archimedes" as applied to gases. On the principle assumed in the answer the gases lighter than air would not only have no weight, but would have (as shown by an attempt to weigh them in air) the opposite quality; that is, the earth would seem to have for them a repulsive force. As a cubic foot of air weighs $n=527$ grains a body will gain 11 grains in weight on weighing in a vacuum, for every cubic foot of its solidity, and this regardless of its original weight in air. In this case the gain will be $3n=1581$ grains, and the body will therefore weigh $150\frac{1581}{527}$ lbs.

A. F. PARSONS.

511. Who were the *Silver Grays*? the *Hunkers*? the *Barn Burners*? the *Woolly Heads*? the *Free Soilers*? the *Know-Nothings*? and the *Anti-Renters*?

ED. RYNEARSON.

Ans.—These terms belong to political factions principally in the state of New York. The Whigs divided in 1850 into two factions, the supporters of President Fillmore being called *Silver Grays*, a designation of the Federalists from wearing the brush of silver-gray foxes on certain public occasions. The other faction bore the denomination of *Woolly Heads*, as referring to the partiality of Wm. H. Seward and his friends to anti-slavery views. The term *Hunkers* was applied to a section of the Democratic party in New York in 1843. *Barnburners* also was a faction of the same party in New York. The name *Free Soilers* dates with 1847-48. It grew out of the famous Wilmot Proviso, which proposed to exclude slavery from the territory to be acquired from Mexico. The *Know-Nothings* was a secret political society, organized in the United States in 1853. One of their leading principles was that "The Americans shall rule America." The *Anti-Renters* was a political party, which, in the four years between 1843 and 1847, made much commotion in a part of the state of New York. This party grew out of rent troubles similar to those of Ireland at the present day.

J. H. W. SCHMIDT.

512. What cities are known by the following nicknames: *Garden City*, *City of Notions*, *Elm City*? Why so called?

Ans.—*Garden City*, a name for Chicago, a city remarkable for the number and beauty of its private gardeus. *City of Notions*, a popular name for Bos-

ton, Mass. *City of Elms*, a familiar name of New Haven, Conn., many of the streets of which are thickly shaded with lofty elms.

MARY RECK.

513. What is the *Milky Way*?

WM. S. DAVIDSON.

Ans.—A luminous cloud-like band that girds the Heavens. It is, when examined through powerful telescopes, found to be composed of *stars scattered by millions*, like glittering dust, on the black ground of the general heavens. To investigate these bodies in relation to their number, magnitude, motion, and the laws by which they are united and directed in their movements, completely baffles the mathematician's skill, and sets at defiance all his hitherto acquired powers of analysis. It is technically termed the *Via Lactea*, or *Galaxy*.

G. H. HARVILL.

514. Give weight of finest platinum wire one mile long. Also the weight of a square inch of finest gold leaf?

Id.

Ans.—A "book of gold," containing 25 leaves of $3\frac{1}{4}$ inches square, equal to an area of 264 square inches, generally weighs from 4 to 5 grains. The finest platinum wire that can be made is about the 500,000th of an inch thick, and a mile of it would not weigh a grain. See *Encyclopedia Britannica*.

EDITOR.

515. Name all the states of the German Empire.

L.

Ans.—The following are the German Empire States:

Kingdoms.—Prussia, Bavaria, Saxony, Wurtemberg.

Grand Duchies.—Baden, Hesse, Mecklenburg-Schwerin, Saxe-Weimar, Mecklenburg-Strelitz, Oldenburg.

Duchies.—Brunswick, Saxe-Meinigen, Saxe-Altenburg, Saxe-Coburg-Gotha, Anhalt.

Principalities.—Schwarzburg-Rudolstadt, Schwarzburg-Sondershausen, Waldeck, Reuss (Alterie Linie), Reuss (Jungere Linie) Schaumburg-Lippe, Lippe-Detmold.

Free Towns.—Lubeck, Bremen, Hamburg, Alsace Lorraine.

PHEBE SHIVES.

516. What college is known as *The Silent Sister*?

J. L. FELLER.

Ans.—Trinity College, Dublin, on account of the little influence it exerts in proportion to its resources.

T. J. BARNES.

517. What is the *Nameless City*?

Id.

Ans.—Nameless City is a name given to Ancient Rome; so called because it had an elder and mysterious name, which it was death to pronounce. This name is said to have been *Valentia*.

ED. RYNEARSON.

518. Who is the author of *The Saint's Everlasting Rest*?

Id.

Ans.—Richard Baxter, who was born at Rowton, England, Nov. 12, 1615, of poor but respectable parents. His education was scanty, and a month at court convinced him that the practice of law was not his element. He was always serious and a protracted illness in his youth deepened his religious convictions. At twenty-three he was ordained a clergyman of the church of England. In 1640 he became parish clergyman of Kidderminster, where he became famous, and greatly improved the manners of the townspeople. His religious sympathies were with the Puritans, and though a Presbyterian by principle, he would not admit the unlawfulness of Episcopacy. These views exposed him to severe criticism and when the civil war broke out in England, he was compelled to retire to Coventry for a few years to avoid the mob. During this time he wrote his *Saint's Rest* and *Call to the Unconverted*. He would never acknowledge the protectorate of Cromwell. On the return of Charles II. to the throne, Baxter was appointed one of his chaplains.

In 1663 he was driven from the established church, and retired to Acton, in Middlesex, and composed many of his works. In 1672 he was permitted to return to London, but in 1685 he was condemned by Judge Jeffries to pay a fine of 500 marks, for alleged sedition in his *Paraphrase of the New Testament*. Being unable to pay it, he was imprisoned for 18 months. He lived after this to see better days, and died Dec. 8, 1691.

Baxter's life was a remarkable one, and his biography is historically valuable. "Pray read with great attention," says Coleridge, "Baxter's Life of himself; it is an inestimable work." Doddridge says, "He discovers a manly eloquence and the most evident proofs of an amazing genius, with respect to which he may not improperly be called the *English Demosthenes*. He preached more sermons, engaged in more controversies, and wrote more books (160 in number) than any other Nonconformist of his age. His peculiar doctrines were: 1st, That though Christ died in a special sense for the elect, yet he died in a general sense for all; 2d, The rejection of the dogma of reprobation; 3d, That it is possible even for saints to fall away from saving grace. Bishop Wilkins asserted that "if Baxter had lived in the primitive time, he would have been one of the fathers of the church."

EDITOR.

519. What does *Id.* mean? *The Great Unwashed?* *Microbe?*

L. C. ROOT.

Ans.—*Id.* is an abbreviation of the Latin *idem*, meaning *the same*. *The Great Unwashed* was a term first used by Burke, calling the mob thus. It was afterwards applied in derision to a portion of the democratic party by antagonistic newspapers and politicians. *Microbe* is derived from two Greek words, *mikros*, small, and *bios*, life, and was coined by Chas. Sedillet, of Strasburg, in Feb. 1878, while preparing his paper on the *Applications of Pasteur's discoveries to Surgery*. Scientific men have since generally adopted the word, yet it is not found in the supplement to Webster's Unabridged dictionary.

EDITOR.

520. Snow never melts on high mountains and is constantly falling. Why do the mountains not increase in height?

LEVI MINNICH.

Ans.—Snow is not constantly falling on high mountains. Portions of it are gradually taken off the atmosphere, or reduced by melting.

GALEN.

521. Who may be considered the father of botany? of democracy?

E. S. HOWELL.

Ans.—[*a*] Carle Von Linne [Linnæus], a Swede, born 1707; died 1778. The greatest of Botanists and Entomologists. [*b*] Thos. Jefferson.

J. M. WHITE.

522. What is the proper pronunciation of Mrs. as applied to married ladies generally?

BUB.

Ans.—Webster says it should be pronounced *Misses*. Supt. T. J. Barnes, J. H. W. Schmidt, Wm. Davidson, and Jno. Kniesly agree with the standard authority; others say *mistress*. Follow Webster and you will display good taste.

EDITOR.

523. What ruler said "He who brings me the head of one of my enemies shall be dearer to me than a brother?" JOHN H. KNIESLY.

Ans.—Canute. See p. 200, Oct. *Visitor*, 1884.

524. Of what species of the genus *Mus* is the Rat of fable? L.

Ans.—The Black Rat, *Mus rattus*, is the Rat of fable. According to tradition this rat devoured the wicked Bishop Hatto, in his tower in the Rhine at Bingen still called Mouse Tower, and wrought such havoc in Hameln till the charm of

the Pied-piper freed the city. This legend is rather interesting. It is said that in 1284 the town was infested with rats, that its inhabitants were almost compelled to leave it, when a piper in fantastic suit appeared, who offered for a certain reward to charm all the vermin into the Weser by his piping. The town agreed to pay him the money asked, but after he had fulfilled his promise, the inhabitants pronounced him a sorcerer and refused to pay him. June 26th he reappeared on the streets, and began a soft, seducing strain on his pipe which drew all the children after him as he led them out of town to the Koppelberg hill, in whose side a door suddenly opened, by which he entered and all the children after him, except one who was lame and could not follow. The town for many years dated its public documents from this great event. The story is the subject of a poem by Robt. Browning and also of one by Julius Wolff. Bishop Hatto, who was archbishop of Mainz in 968 was consumed by the rats about 970, according to the legend.

EDITOR.

525. Where is the Bridge of Boats ?

L.

Ans.—The Bridge of Boats crosses the river Rhine, and connects the two cities, Cologne and Deutz.

JOHN H. KNIESLY.

526. Who were the *Seven Sleepers of Ephesus* ?

L.

Ans.—The Seven Sleepers of Ephesus are the heroes of the legend which is first related by Gregory of Tours in the close of the 6th c., but the date of which is assigned to the 3rd c., and to the persecution of the christians under Decius, a Roman emperor. During the flight of the christians under persecution, seven christians of Ephesus took refuge in a cave near the city, where they were discovered by their pursuers, who walled up the entrance in order to starve them to death. A miracle was interposed in their behalf. They fell into a preternatural sleep, in which they lay for nearly 200 yrs. On awakening they imagined that their sleep had been but of a single night; and on one of the party (supposing the persecution still in progress) going into the city to purchase provisions privately, he was amazed to find erected, in triumph, on the churches and other buildings, a cross, which, as it seemed, but a few hours before he had seen the object of contempt and blasphemy. They all died at the same moment, as if by one common and mysterious destiny.

H. F. DERSHEM.

527. Give a list of nicknames for important cities.

L.

Ans.—Atlanta, Gate City of the South; Baltimore, Monumental City; Bangor, Lumber City; Boston, Modern Athens, Literary Emporium, City of Notions, and Hub of the Universe; Brooklyn, City of Churches; Buffalo, Queen of the Lakes; Burlington [Iowa], Orchard City; Charleston, Palmetto City; Chicago; Prairie, or Garden, City; Cincinnati, Queen of the West and Porkopolis; Cleveland, Forest City; Denver, City of the Plains; Detroit, City of the Straits; Hartford, Insurance City; Indianapolis, Railroad City; Keokuk, Gate City; Lafayette, Star City; Leavenworth, Cottonwood City; Louisville, Falls City; Lowell, Spindle City; McGregor, Pocket City; Madison, Lake City; Milwaukee, Cream City; Nashville, Rock City; New Haven, Elm City; New Orleans, Crescent City; New York, Empire City, Commercial Emporium, Gotham, and Metropolis of America; Philadelphia, City of Brotherly Love, City of Penn, Quaker City, and Centennial City; Pittsburgh, Iron City, and Smoky City; Portland [Me.], Hill City; Providence, Roger Williams's City, and Perry Davis's Pain Killer; Raleigh, Oak City; Richmond [Va.], Cockade City; Richmond [Ind.], Quaker City of the West; Rochester, Aqueduct City; Salt Lake City, Mormon City; San Francisco, Golden Gate; Savannah, Forest City of the South; Sheboygan, Evergreen City; St. Louis, Mound City; St. Paul, North Star City; Vicksburg, Key City; Washington, City of Magnificent Distances; and Federal City; Athens [Greece], City of the Violet Crown.

From *Treasures of Science, History and Literature*.

529. Who nominated Franklin Pierce for the Presidency of the United States ? *Id.*

ANS.—On the 12th of June, 1852, the Democratic convention met in Baltimore to nominate a candidate for the presidency. For four days they continued in session, and in thirty-five balloting no one had obtained a two-thirds vote. Not a vote had thus far been thrown for Gen. Pierce. Then the Virginia delegation brought forward his name. There were 14 more ballotings, during which Gen. Pierce constantly gained strength, until, at the forty-ninth ballot, he received two hundred and eighty-two votes, and all other candidates eleven.

CHAS. E. MANN.

530. What Generals were known as the "Game Cock," and "Swamp Fox" ? *Id.*

ANS.—The title of "Game Cock" was given to Gen. Thomas Sumpter from his valorous achievements in South Carolina during the campaign of 1780. Gen. Francis Marion was known as "Swamp Fox," his retreat from pursuit, being in the swamps of the Carolinas. He was also called the "Bayard of the South."

DELIA GARVER.

531. Why was 36° 30' taken as the boundary between the slave and the free states as given in the Missouri compromise ? L. M. O.

ANS.—Because it is the southern boundary of Penn., separating it from the slave states Md. and Va. The phrase "Mason and Dixon's Line" was originated by John Randolph, of Va., in discussing the Missouri Compromise.

T. J. BARNES.

532. What was the weight of Daniel Webster's brain ? *Id.*

ANS.—I have seen it stated somewhere, I forget now where, that his brain weighed 63 ounces. But in "Notes Queries & Answers" for Dec. 1884, I see it given 53.5 ounces. Which is right?

G. H. HARVILL.

Will Mr. Brenizer, referred to above, give us his authority for the weight of Webster's brain ? Also that of Cuvier ? Cutter says Cuvier had the largest brain on record, giving its weight 4 pounds and 13½ ounces.

EDITOR.

533. Who hung out the light for Paul Revere ? *Id.*

ANS.—It was John Pulling, a warden and vestryman of the North Church, who displayed the signal lights. He and Paul Revere were intimate friends from boyhood, and always acted together. Both were members of a league of about thirty persons, established to detect the movements of the British soldiers. Every member thereof was solemnly sworn not to divulge their reports and plans to any persons not members of committees chosen by the league. Hancock, Adams, Revere, Pulling, and others served on committees. Paul Revere and John Pulling were also members of the Boston Committee of Correspondence, Inspection, and Safety, and acted together on a committee appointed by a convention of freeholders at Boston, to collect the names of all persons who had in any way opposed the rights and liberties of this country. Soon after the memorable ride by Paul Revere, which forms the subject of one of Longfellow's poems, John Newman, the sexton of the North Church, was arrested on suspicion for holding out the lights. He asserted his innocence and was released on his testimony that at a late hour of the night the keys of the church were demanded of him by John Pulling, who, being a vestryman, was entitled to the same; and after giving them up he returned to bed again. Pulling was secretly warned of this and made his escape from the neighborhood under the disguise of a laborer. See *Boston Advertiser*, July 20, 1876, and *The Nation*, July 27, 1876.

EDITOR.

534. Who was the man in the iron mask ? *Id.*

ANS.—He was a French prisoner, whose identity has never been satisfactorily established. He was carried, about the year 1679, with the greatest secrecy, to the castle of Pignerol, of which Saint Mars was governor. He wore, during

the journey, a black mask, and orders were given to kill him if he discovered himself. The mask was not of iron, but of black velvet, strengthened with whalebone, and secured behind the head with steel springs, or, as some assert, by means of a padlock. In 1686, he was carried by St. Mars to the isle of Sainte Marguerite. In 1698, he was conveyed to the Bastille where he died Nov. 20, 1703. He was treated with the utmost respect, but closely watched, and not permitted to take off his mask even before his physician. Many conjectures have been hazarded as to who this mysterious personage could have been. One opinion is, that he was the son of Anne of Austria. Others suppose him to have been a twin brother of Louis XIV. It has more recently been surmised that Fouquet was the mask. This opinion is the one generally received by those who have investigated the subject. WM. S. DAVIDSON.

536. Give the length of the earth's shadow. L. B.

Ans.—The length of the earth's shadow-cone is variable, being as great as 870,300 miles when the earth is in aphelion, and as small as 843,300 miles when the earth is in perihelion. It extends about $3\frac{1}{2}$ times as far from the earth as the moon's orbit, hence we have lunar eclipses. EDITOR.

537. How was the velocity of light discovered? WM. DAVIDSON.

Ans.—The velocity of light was first discovered by Roemer, a Danish astronomer. It was done by calculations and observations of the eclipse of one of Jupiter's moons. The velocity of light is 183,000 miles per second. The method of calculation in finding the velocity of light is too cumbersome, but if required I will give it in full. G. H. HARVILL.

538. Describe the planet last discovered. Id.

Ans.—Neptune was the last planet discovered. Dr. Steele says "It is the far-off sentinel at the very outposts of the solar system, being the most distant planet of which we have any knowledge." Its diameter is about 37,000 miles. It moves in space a little over 12,000 miles per hour. Its distance from the sun is slightly over 2,750,000 miles. The Neptunian year is nearly 165 terrestrial ones. Of its seasons, the inclination of its axis, etc., we know nothing. It has one moon. This planet was discovered in 1845, almost simultaneously by Leverier of Paris, and Mr. Adams, of Cambridge. G. H. HARVILL.

539. Why does the presence of pepsin, or rennet in sweet milk separate the serum from the cheese portion of it; what chemical changes take place, and does the milk pass through a souring process on effecting the separation? Marcellus.

Ans.—The pepsin causes a species of coagulation, in which an insoluble casein arises from splitting up under the influence of the ferment (which is not identical with pepsin, according to Hammerstein, of Upsala, who has succeeded in separating them,) of a previously soluble body. The casein precipitates on account of its greater specific gravity.

In the absence of an exact knowledge of the constitution of proteids, the precise nature of the changes can not be distinctly stated, but judging from the analogy with the action of saliva on starch, we may suppose that the process is one of hydration.

Peptic digestion is essentially an acid digestion, best carried on in presence of HCl [*Hydrochloric Acid*] to the extent of .2%. In this case spontaneous formation of lactic acid is produced (according to recent investigations by Dr. Hueppe, of Wiebaden, published, Nov. 27, 1884) by a short bacellus, which converts the sugar of the milk into lactic acid and carbonic acid. A full account of Dr. Hueppe's investigations may be seen in the *Deutch Med. Wochenschrift* of the above date. S. P. DRAHOFE.

540. On the American Continent before the introduction of man in this planet, horses were more numerous than in any other part of the world; what conditions led to their extinction? Marcellus.

ANS.—It will not be contended that horses were on this Continent at the time of its discovery, yet the conditions for equine existence were abundant; evidenced by much pasturage in the temperate regions of North and South America, and especially in the Pampas of the latter. The fossil remains of the horse and other animals found on Ashley Rivers and other sections in the South indicates that he was a pre-historic animal on this Continent and passed into non-existence with the *elephantidae* tribe; consequently the premises of the interrogatory cannot be controverted, although scientists have been unable as yet to give conditions leading to the extinction of the horse. PROPOSER.

541. How and when was the Zuyder Zee formed? COSMOS.

ANS.—In the time of the Romans the Zuyder Zee was a low swampy lake called Flevo, and communicated with the North Sea by a stream bearing the name of Flevum. In 1219 a severe inundation took place in consequence of continued N.W. winds, broke down the dikes and made considerable encroachments on the land. In 1282 a still more terrible one occurred, which submerged 72 towns and villages, drowning nearly 100,000 persons. By this calamity it became an arm of the sea, and attained its present dimensions.

WM. DAVIDSON.

542. Where and what are San Marino, Andorra, Liberia, and Montenegro? *Id.*

ANS.—San Marino is in the north-eastern part of Italy, the oldest republic in the world, and next to Monaco, the smallest State in Europe. According to tradition, it was settled in the fourth century, by Marinus, a Dalmatian hermit, and has always since remained independent. It is on the summit of a rugged mountain, and has a remarkable cabinet of medals, 5 churches, 2 convents, and a town house.

Andorra is a semi-independent State, in a valley of the Pyrenees, partly under control of the Bishop Urgal. It is situated between Urgal, Spain, and Faix, France.

Liberia is on the western coast of Africa. The republic owes its origin to the American Colonization Society, which in 1820 sent the first colonists.

Montenegro was, until 1878, tributary to Turkey, but is now independent. It is a limited monarchy.

ED. RYNEARSON.

543. Describe the Maelstrom off the coast of Norway. *Id.*

ANS.—The *Maelstrom* is situated near the Norwegian coast in 68° N. Latitude—in the great province of Nordland in the dreary district of Lofoden. The Norwegians sometimes call it Moskoestrom, from the island of Moskoe in the distance. Between Moskoe and the coast the vast bed of the waters seam and sear into a thousand conflicting channels, bursting suddenly into frenzied convulsions gyrating in gigantic and innumerable vortices, whirling and plunging onto the eastward with a rapidity water never assumes except in precipitous descents. The surface of the water grows more smooth, and the whirlpools disappear, while prodigious streaks of foam become apparent. These streaks, at length, spread out to a great distance, and enter into combination, taking unto themselves the gyratory motion of the subsided vortices, and form the germ of another more vast. Suddenly this assumes a distinct existence. The edge of the whirl is represented by a broad belt of gleaming spray; but no particle of this slips into the mouth of the terrific funnel, whose interior, as far as the eye can fathom it, is a smooth, shining, jet-black wall of water, inclined to the horizon at an angle of some 45°, speeding dizzily round with a swaying motion, and regularly sending forth to the winds an appalling voice. The stream is regulated by the flux and the reflux of the sea—it being constantly high and low water every 6 hours.

The idea generally received is that this has no other cause than the collision of waves rising and falling, at flux and reflux, against a ridge of rocks and shelves, which confines the water so that it precipitates itself like a cataract;

MABEL HERSHEY.

J. H. S.

EDITOR.

Marcellus.

GENEVIEVE PRICE.

Marcellus.

he | knowing | { I
loved | books | my
furnished | me
with volumes | { I
prize | *that*
from library | my own | above dukedom | my

J. H. W. SCHMIDT, C
521, 522, 526, 532, 534.

QUERIES.

578. Who established the first orphan asylum in America?

GEO. L. SHANER.

579. What noted man of Ohio defeated his competitor for Congress by a single vote, and afterwards married his competitor's favorite daughter?

Id.

580. What was the Koszta Affair? Give incident.

JOHN H. KNIESLY.

581. Who was chaplain of the old Continental Congress, and where did that Congress meet?

Id.

582. Give the legends about the robin.

L. C. ROOT.

583. Why are counties in La. called parishes?

Id.

584. What is a bill of attainder? an *ex post facto* law?

THOS. MILLER.

585. Who was the "Swamp Angel" of the late civil war?

Id.

586. When was a general blown up by a magazine in the moment of his victory?

ED. RYNEARSON.

587. What do the names San Salvador, Santa Cruz, Vera Cruz, La Trinidad indicate?

Id.

588. Of what illustrious English statesman was it said that "he had a head to contrive, a tongue to persuade, and a hand to execute?"

CHAS. BIGLER.

589. Explain how a person in New York may receive a telegram the day before it is sent from Paris?

A. G.

590. Give origin and meaning of the expression, carrying coals to Newcastle.

Id.

591. What is gum copal?

L. A. REED.

592. Is the puff-ball a plant? If so, describe its growth.

Id.

593. Why has the U. S. flag a *five-pointed* star? Give method of drawing such a star.

L. B.

594. What room with seven doors and one window is noted in U. S. History?

Id.

595. Give a list of "Famous Rides" with brief incidents.

Id.

596. Give a rule for finding the day of the week for any date.

Id.

597. Who was "The Inspired Tinker"?

A. G. GUNDER.

598. Who was called the "Water Poet."

Id'

599. Must persons be of a certain age before they can get license to teach?

Id.

600. What were the "Sicilian Vespers"?

JNO. KNIESLY.

601. What noted events occurred on the 19th of April?

ED. RYNEARSON.

NOTE.—Answers should reach us by April 6. Send good queries.



EDITED BY

JOHN S. ROYER.

VOL. VI.

APRIL, 1885.

No. 4.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

688. *By B. F. BURLERSON, Oneida Castle, N. Y.*—In testing the strength of oak I found that a stick one inch= b in breadth, one inch= d in dep'h. and 4 feet= l in length, when supported at its ends, would just sustain $P=100$ lbs. and no more at its middle point without breaking. I have an oak tree from which I can cut a log $L=30$ feet in length, that will be $2r=2$ feet in diameter at its smaller end. If I hew a rectangular beam from it possessing maximum strength, what will be the maximum weight it will sustain when evenly loaded and supported at both ends?

By W. L. HARVEY, Maxfield, Me.

The strength of a rectangular beam is proportional to the area of a cross-section, multiplied by the depth. To get the cross-section, let r = radius of log, $2x = b$ = breadth of section, then $d = 2\sqrt{(r^2 - x^2)}$, the depth; therefore $2x \times [2\sqrt{(r^2 - x^2)}]^2$, or $8xr^2 - 8x^3$ = a maximum. The first differential coefficient is $r^2 - 3x^2$, and let this equal 0 [naught], then $3x^2 = r^2$ or $x = r \div \sqrt{3}$ and $2x = 2r \div \sqrt{3} = b$; and $d = 2r\sqrt{\frac{2}{3}}$.

The formula is $w = c(bd^2 \div l)$ where w = breaking weight in tons, b = breadth of beam in inches, d = depth in inches, and c = a constant number for beams of the same material. Substituting one inch for b and d in the formula, 48 inches for l , and $\frac{1000}{216} = \frac{1}{216}$ for w , gives $c = 2.4$. Substituting this value of c and 360 for l , we have

$$w = 2.4 \times [(2r \div \sqrt{3}) \times \frac{8}{3}r^2] \div 360 = 35.4726 \text{ tons.}$$

That is, if the whole weight is in the middle of beam. If loaded evenly the whole length, it is $35.4726 \times 2 = 70.9452$ tons. I assumed the strength of beam proportional to that of the stick, which is not strictly true, as the weight of the material should be considered.

NOTE.—In next issue we shall give D. H. Davison's ingenious method of inscribing series of circles. He has computed over 700 circles thus inscribed. This will be worth a year's subscription to *Visitor*.

By the PROPOSER.

The moment of resistance for rectangular beams whose sides are vertical, as determined by Mechanics, is $\frac{1}{6}Rbd^2$; in which R represents the "Modulus of Rupture," and b and d the breadth and depth of the beam. In the case of the testing stick of oak by taking the origin of moments about its middle or breaking point, we have $\frac{1}{4}Pl = \frac{1}{6}Rbd^2$. Hence, $R = 3Pl \div 2bd^2 = 7200$ lbs.

The strongest rectangular beam that can be sawed from a cylindric log may be found by the following construction: Trisect the diameter AB of the log in the points C and D . Draw perpendicular to AB , and on opposite sides of it, CF and DG , the points F and G being in the circumference of the log. Join AF , FB , BG , and GA , forming the rectangle $AFBG$, which will be a cross-section of the strongest rectangular beam that can be cut from the log. The proof of this construction is easily made apparent by the aid of the differential calculus. We determine analytically, therefore, by the aid of Prop. 27, B. IV., Loomis's Geom., that the breadth of the log's strongest beam is $B = \frac{2}{3}r\sqrt{3}$, and its depth $D = \frac{2}{3}r\sqrt{6}$. Let W = the required greatest supporting weight of the beam. We have by taking the origin of moments at its middle and quarter distant points, and taking their difference $\frac{1}{4}WL - \frac{1}{8}WL = \frac{1}{8}WL = \frac{1}{6}RBD^2$. Hence, $W = 4RBD^2 \div 3L = 4 \times (3Pl \div 2bd^2) \times \frac{2}{3}r\sqrt{3} \times \frac{2}{3}r\sqrt{6} \times \frac{2}{3}r\sqrt{6} \times (\frac{1}{3} \div L) = 32Plr^3\sqrt{3} \div 9Lbd^2 = 141889\frac{2}{3}$ lbs.

COROLLARY.—A beam when evenly loaded will support just twice as much weight as it will when only loaded in its center.

Also solved by Messrs. Drummond, Parsons, Gunder and Sublette.

689. *By B. F. BURLERSON.*— A and B set out from the same place in the same direction; A travels uniformly 20 miles a day, and after 4 days turns and goes as far as B has traveled during those 4 days; he then turns again, and pursuing his journey overtakes B 24 days after the first set out. At what rate per day did B uniformly travel?

By A. M. SCRIPTURE, Clinton, N. Y.

If A had traveled in the same direction during the 24 days, he would have advanced $20 \times 24 = 480$ miles. But having gone 80 miles, he, in retracing his course and again advancing to the 80th mile post, loses as much distance as B accomplishes in 8 days or $\frac{1}{3}$ of his time. Therefore, 480 miles exceeds B 's distance by $\frac{1}{3}$ of the same distance. The distance B traveled equals $480 \div \frac{4}{3} = 360$, and his rate per hour is $360 \div 24 = 15$.

Solved thus by Harry Dershem, Geo. L. Shaner and Alex. Knisely.

By DR. S. P. BARTLETT, *E. Dixfield, Me.*

Let x = B's rate per day; then $24x$ = distance B traveled, and 20×24 or 480 is the distance A travels in all. A loses out of this what B travels in 4 days twice over, or $8x$; $\therefore 24x = 480 - 8x$, whence $x = 15$.

Solved algebraically by A. L. Foote, W. L. Harvey, A. F. Parsons, Ed. Ry-
nearson, Geo. C. Russell, J. R. Baldwin, G. W. Sublette, Wm. Wiley, H. A. Wood,
Josiah H. Drummond, Cooper D. Schmitt, H. Gunder, L. A. Reed and Proposer.

690. By A. G. GUNDER, *Darke, Ohio.* A, in running a race with B to a post and back, met him 10 yards from the post. To make it a dead heat, B should have increased his rate from this point $41\frac{2}{7}$ yards per minute; but if without changing his pace, he had turned back on meeting A, he would have come out 4 seconds after him. How far was it to the post?

By CHARLES M. SMITH, *Byron Center, N. Y.*

Let x = No. of yards to the post, y = No. of yards A runs per minute, z = No. of yards B runs per minute; then

$$(x-10) \div z = (x+10) \div y \dots (1),$$

$$(x-10) \div y = (x+10) \div (z+41\frac{2}{7}) \dots (2),$$

$$(x-10) \div z = (x-10) \div y + \frac{1}{15} \dots (3).$$

$(1) - (3)$, $(x+10) \div y - (x-10) \div y - \frac{1}{15} = 0 \dots (4)$, from which $y = 300 \dots (5)$. Substituting 300 for y in (1), etc., we obtain

$$x+10 = 300 \div z(x-10) \dots (6).$$

Substituting $300 \div z(x-10)$ for $x+10$ in (2), clearing of fractions, dividing by $x-10$, etc., we get $z^2 + \frac{29}{7}z = 30000 \dots (7)$. Completing the square, $z^2 + \frac{29}{7}z + (\frac{145}{7})^2 = 44\frac{3}{4} \dots (8)$. Extracting square root and transposing $z = 280 \dots (9)$. Substituting in (1) the obtained values of y and z and clearing of fractions,

$$300x - 3000 = 280x + 2800 \dots (10).$$

Transposing, $20x = 5800 \dots (11)$; dividing by 20; $x = 290 \dots (12)$, the No. of yards to the post as called for by the problem.

J. C. Gregg, W. L. Harvey, A. L. Foote, Cooper D. Schmitt, H. A. Wood, L. A. Reed, D. H. Davison, W. B. Anderson, A. F. Parsons, J. C. Corbin and J. M. White also solved it.

691. By the same.—The hypotenuse of a right triangle is 20. and its area is 96. Determine the sides.

By D. W. K. MARTIN, *Webster, Ohio.*

Let x = base and y = perpendicular. Then $x^2 + y^2 = 20^2 \dots (1)$, $\frac{1}{2}xy = 96 \dots (2)$. Multiplying (2) by 4, adding to (1), and extracting the square root, we have $x+y = 28 \dots (3)$. Subtracting it from (1) and finding the square root, we have $x-y = 4 \dots (4)$. Adding (3) and (4), we find $x = 16$, and $y = 12$.

Solved by Messrs. Tait, Wiley, Leahy, Foote, Smith, Reed, Schmitt, Russell, Scripture, Cagwin, Anderson, Corbin, Oliver, Bartlett, Wood, Leisy, McKibben, Parsons, Gregg and Proposer.

By J. M. WHITE, Burlington Junction, Mo.

Evidently, the sum of the squares of the required sides is 400, and their product 192. By inspection, we find that the least integral number whose square taken from 400 will leave a square for remainder, is 12. Hence 12 and $\sqrt{400-144}=16$, are the sides required.

692. *By ED. RYNARDSON, Gettysburg, Ohio.*—A merchant bought 15 pieces of cloth, each containing 20 yards, at $\$5\frac{1}{4}$, on a credit of 8 months, and sold them at $\$6\frac{1}{6}$, on a credit of 3 months; what was his cash gain at 6%? *From Brooks.*

By GEO. L. SHANER, Stewart's Station, Pa.

The present worth of cost is $\$5\frac{1}{4} \times 20 \times 15 \div 1.04 = \1514.423 ; the present worth of selling price is $\$6\frac{1}{6} \times 20 \times 15 \div 1.015 = \1801.344 ; the gain is $1801.344 - 1514.423 = \$286.921$.

D. W. K. Martin, G. W. Leahy, Chas. M. Smith, Homer M. Knowles, H. A. Wood, R. A. Leisy, J. M. White, J. C. Gregg and Proposer got the same result. Solved differently by A. G. Gunder, J. C. Corbin, A. F. Parsons, A. M. Scripture, G. C. Russell, W. B. Anderson and F. W. Wertz.

693. *By Request.*—A merchant buys goods for \$475.60, and after keeping them on hand 7 months, sells the same for \$560.80; what per cent profit does he make, money being worth 6%?

By PROF. GEO. C. RUSSELL, Woodland, Cal.

The cost of goods when sold is $\$475.60 \times 1.035 = \492.246 ; the gain is $560.80 - 492.246 = \$68.554$; hence, $68.554 \times 100 \div 492.246 = 13.92\%$ is the rate.

Same result in the solutions of Prof. H. A. Wood, A. F. Parsons, Ed. Rynardson, Prof. W. B. Anderson, Chas. M. Smith, J. C. Gregg, A. M. Scripture, Geo. W. Leahy, F. W. Wertz and A. G. Gunder. A. L. Foote uses a different method.

By D. W. K. MARTIN, Webster, Ohio.

The present worth of \$560.80 for 7 mo. at 6% = \$544.20, and the profit is $(544.20 - 475.60) \div 475.60 = 14.42\%$.

Prof. J. C. Corbin, J. M. White and Homer M. Knowles give Mr. Martin's result. This is the method adopted in Ray's Arithmetic.

694. *By J. R. BALDWIN, Blue Grass, Iowa.*—Prove that any prime number which, when divided by 4, leaves a remainder of unity, is the sum of two square numbers.

By J. C. CORBIN, Little Rock, Ark.

It is known that the sum of the odd numbers, commencing with 1, equals the square of the number of terms, and we can write

$$n^2 = 1 + 3 + 5 + 7 + 9 + 11 + 13 \dots,$$

$$n_1^2 = 1 + 3 + 5 + 7 + 9 + 11 \dots$$

Adding, $n^2 + n_1^2 = 1 + 4 + 2 \times 4 + 3 \times 4 + 4 \times 4$, etc., the second member being divisible by 4, with a remainder of 1. So the proposition is not restricted to prime numbers.

By A. L. FOOTE, *Hempstead, L. I.*

Every prime number except 2, when divided by 4, leaves a remainder of 1 or 3. Let n be any prime number, then $n \div 4 = q + \frac{1}{4}$ or $q + \frac{3}{4}$. Now since the remainder $\frac{1}{4}$ is a square, we must either have q a square or $q - \frac{3}{4}$ a square to fulfill the conditions. Let $q - \frac{3}{4} = m^2$, then $q = m^2 + \frac{3}{4}$ and consequently we have $q - \frac{3}{4} =$ a square whatever value we give m ; so we have the expressions $n = q + \frac{1}{4}$ in which q is a square, and $(q - \frac{3}{4}) + (\frac{1}{4} + \frac{3}{4}) = q + \frac{1}{4}$, in which $(q - \frac{3}{4})$ and $(\frac{1}{4} + \frac{3}{4})$ are each squares.

695. By B. F. BURLERSON, *Oneida Castle, N. Y.*—Solve the equation

$$\left(\frac{w^4-1}{w^{12}}\right)^{\frac{1}{4}} + \left(\frac{w^3-1}{w^4}\right)^{\frac{1}{2}} = 1.$$

By D. H. DAVISON, *Minonk, Ill.*

It is evident that value of w exceeds 1. We can assume $w = 1.1$; verifying this value by use of logarithms as shown below we find it is a trifle too small. Assume another value a little larger and after verifying it, we can apportion errors of the two results and find

$$w = 1.1008433 \text{ Log. } .0417255,$$

$$w^2 = 1.211856 \text{ Log. } .0834510,$$

$$w^4 = 1.468595 \text{ Log. } .1669020,$$

$$w^{12} = 3.167422 \text{ Log. } .5007060.$$

$.468595 \text{ Log. } 1.6707976, - .5007060 = 1.1700916, \div 4 = .2925229$, No. $= .6201873$, 1st term; $.211856 \text{ Log. } 1.3260408, - .1669020 = .1591388$, $\div 2 = .0795694$, No. $= .3798127$, 2nd term. The sum of these two terms $= 1$, showing the value of w , is accurate as can be determined by use of logarithms true to seven decimal places.

NOTE.—Mr. Davison used the negative characteristic (τ) in each of the above logarithms and as we have no figures with a horizontal line over each, we use the inferiors of piece fractions.

By the PROPOSER.

Clearing the equation from fractions, etc.,

$$(w^4-1)^{\frac{1}{4}} = w^3 - w(w^3-1)^{\frac{1}{4}} \dots (1).$$

Clearing (1) from radicals by three successive involutions,

$$w^{24} - 4w^{22} + 10w^{20} - 16w^{18} + 17w^{16} - 28w^{14} + 22w^{12} + 12w^{10} - 10w^8 - 4w^6 = -1 \dots (2).$$

Solving (2) as an equation of the 12th degree, wanting terms containing the first and second power of w , we find as one of the roots by the method of detached coefficients that

$$w^2 = 1.21187178. \therefore w = 1.10085 \pm.$$

696. By W. L. HARVEY, *Marfield, Me.*—A bird sits on the top of a tree 50 feet high. How high above the top of the tree must a boy, standing 100 feet from the tree, aim his arrow, to hit the bird, the velocity of the arrow at starting being 100 feet per second?

By PROF. COLMAN BANCROFT, *Hiram, Ohio.*

Let A represent the point where the arrow leaves the string, B the foot of the tree, T the top of the tree, and P the point directly over the top, at which the arrow is aimed. Put $a = 50$, height of tree, $b = AB = 100$, $v = 100$, initial velocity of arrow, $g = 32.16$, acceleration of gravity, t = time required for arrow to fly to T , and $x = TP$, the required distance. Then $AP = vt$, the hypotenuse, and as x is the distance a body would fall in t seconds, we get

$$t^2 = 2x \div g, \text{ and } AP^2 = v^2 t^2 = 2v^2 x \div g \\ = (x+a)^2 + b^2 = x^2 + 2ax + a^2 + b^2.$$

Hence,
$$x^2 + \left(2a - \frac{2v^2}{g}\right)x = -(a^2 + b^2),$$

and
$$x = \frac{v^2}{g} - a \pm \sqrt{\left\{\left(\frac{v^2}{g} - a\right)^2 - (a^2 + b^2)\right\}}.$$

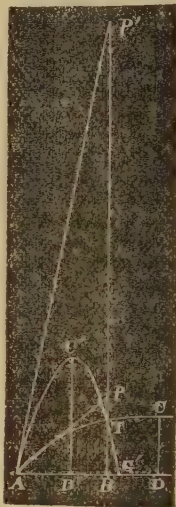
Substituting numbers,

$$x = \frac{10000}{32.16} - 50 \pm \sqrt{\left[\left(\frac{10000}{32.16} - 50\right)^2 - (2500 + 10000)\right]} \\ = 260.94527 \pm 235.78048 = 25.1648 \text{ ft., or } 496.7257 \text{ ft., Ans.}$$

Let P' be the point of aim corresponding to the greater value of x , $e = \angle BAP$, and $e' = \angle BAP'$. Then $\tan e = (50 + 25.1648) \div 100 = .751648$, and $e = 36^\circ 55' 41''$. Then vertical component of initial velocity is $100 \sin e = 60.08$ ft. Therefore, if no resistance is found except from gravity, the time of ascent of the arrow to its highest point C is $60.08 \div 32.16 = 1.868$ sec., and the height CD is $(60.08)^2$ divided by $(2 \times 32.16) = 56.1195$ ft. The horizontal component of the velocity is unchanged by gravity and is $100 \cos e = 79.931$ ft.; hence $2AD = 79.931 \times 1.868 \times 2 = 298.654$, the range of the arrow.

Similarly, $e' = 79^\circ 38' 7''$; $C'D' = 134.895$ ft.; time of arrow's flight to C' is 3.0587 sec.; and $2AD' = AG' = 110.064$ ft. the range of arrow. Thus it appears that for the elevation e the arrow reaches its mark while it is still rising, but for the elevation e' the arrow reaches the same point while descending. The two different paths are represented, approximately, by $ATCG$ [G is not shown in figure] and $AC'TG'$, which are parabolas.

Excellent solutions furnished by J. C. Gregg, A. F. Parsons, A. L. Foote, H. A. Wood, Wm. Wiley and Proposer.



697. By N. R. OLIVER, M. D., *Dorchester Station, Ontario, Can.*—Suppose a pole 156 feet high and upon its top sits a bird at which three men are to shoot, all of them at equal distances from the pole. A is 50 feet from B, B 66 feet from C, and C 104 feet from A. How far must he shoot, who hits the bird?

By G. W. LEAHY, *Marshallville, Ohio.*

The distance required is the hypotenuse of a right triangle, whose perpendicular is 156 feet and base the radius of the circle that circumscribes the given triangle. Representing the sides of any triangle by a , b , and c , its area by A , and radius of its circumscribing circle by R , we have $abc \div 4A = R$. The area of a triangle, whose sides are 50, 66, and 104, is 1320 sq. ft. Applying this formula, we have

$$(50 \times 66 \times 104) \div (1320 \times 4) = 65.$$

The distance is $\sqrt{(156^2 + 65^2)} = 169$ ft.

Messrs. Schmitt, Parsons, Davison, Bancroft, Wiley, Scripture, Foote, Wood, Bartlett, Cagwin, Harvey, Leisy, White, Gregg, Tait and Anderson solved it.

698. By the same.—Solve the equations,

$$\begin{aligned} x^2 + y^2 &= 13900 + x^3 \dots (1), \\ x^8 + y^3 &= 654508000000 + y^4 \dots (2). \end{aligned}$$

By D. H. DAVISON, *Minonk, Ill.*

Put $a = 13900$, and $b = 654508000000$; then from (1)

$$y^2 = a + x^3 - x^2, \quad y^3 = \sqrt{(a + x^3 - x^2)(a + x^3 - x^2)}, \quad y^4 = (a + x^3 - x^2)^2.$$

Substituting these values of y^3 and y^4 into (2) and transposing x^8 , we obtain $\sqrt{(a + x^3 - x^2)(a + x^3 - x^2)} = b + (a + x^3 - x^2)^2 - x^8 \dots (3) = (2)$. Squaring each member, arranging terms, and we have the general formula

$$\begin{aligned} x^{16} - 2x^{14} + 4x^{13} - x^{12} - 4(a+1)x^{11} + 2(2a+3)x^{10} + (4a-5)x \\ - 2[(a^2+b) + 2(3a-1)]x^8 + 3(4a-1)x^7 + [a(6a-7) + 2b+1]x^6 \\ - 2[2b+3a(2a-1)]x^5 + [2b+3a(2a-1)]x^4 + a[4(a^2+b) - 3a]x^3 \\ - a[4a(a^2+b) - 3a]x^2 = a^3 - (a^2+b)^2. \end{aligned}$$

Restore values of a , b , and by general rule for numerical solution of higher equations, find $x = 30$; and by substitution $y = 200$.

699. By the same.—There is a mould candle 15 inches long, which will burn in an arithmetical progression for 9 hours; if an inch at the lesser end is consumed 20 minutes sooner than the same length at the larger end, how long will the first inch burn?

By A. M. SCRIPTURE, *Clinton, N. Y.*

Since there are 15 terms there will be 14 differences, and $20 \div 14 = 1\frac{1}{7}$ = common difference; $60 \times 9 = 540$ = sum of all the terms. Then we have given the number of terms, the common difference, and the sum of all the terms, to find the terms; $(540 \times 2) \div 15 = 72$, the sum of

the first and last term; 20 is the difference of the same two numbers. Half the sum plus half the difference equals the greater, and half the sum minus half the difference equals the less; $\frac{7}{2} \div \frac{2}{2} = 46 =$ time it takes last inch to burn; $\frac{7}{2} - \frac{2}{2} = 26 =$ time it takes first inch to burn.

By JOHN C. GREGG, A. M., *Brazil, Ind.*

Let $x =$ No. of minutes 1st inch burns, $x + 20 =$ No. of minutes 15th inch burns. Substituting in the formula $s = (a + l)(n \div 2)$, we obtain $540 = (2x + 20) \frac{15}{2}$. Hence, $x = 26$ min.

S. P. Bartlett, J. M. White, D. W. K. Martin, A. F. Parsons, Chas. M. Smith, D. H. Davison, W. L. Harvey, Cooper D. Schmitt, A. L. Foote, W. B. Anderson, H. A. Wood, Ed. Ryneanson and Proposer solved it.

700. *By the same.*—Suppose a spiral tube winds round a cylindrical tower, making an angle of $60^\circ 5'$ with the horizon, and a ball falls freely from the vertex along the tube by its own gravity in 8 seconds. Required the perpendicular height of tower.

By PROF. H. A. WOOD, 204 East 51st Street, New York.

Let $l =$ length of the tube, $h =$ height of tower, and $t =$ time of falling the height of the tower. Then, by a well-known principle of philosophy, we get $8 : t :: l : h :: 1 : \sin 60^\circ 5'$; whence $t = 6.934 +$ seconds. We have $s = \frac{1}{2}gt^2$. This equation gives $s = h = 773.126 +$ ft.

Prof. Wm. Hoover gave an elegant solution by the Calculus, and J. C. Gregg, A. F. Parsons, J. M. White, A. M. Scripture, D. H. Davison, W. L. Harvey and Colman Bancroft solved it also.

701. *By Request.*—A bought 450A. 48P. of land, at \$2 an acre, borrowing the money to pay for it at 5%. After 3 yr. 7 mo. 19 da., he sold it at an advance of \$299.40 on cost. If meanwhile he paid \$45.25 for taxes on the land, did he gain or lose by the speculation, and how much?—*Royer's Problems in Mathematics.*

By N. R. OLIVER, *Dorchester, Ontario.*

The cost of the land is $450.3 \times \$2 = \900.60 ; interest on this, for 3 yr. 7 mo. 19 da. at 5%, is \$163.734; whole cost is $900.60 + 163.734 + 45.25 = \1109.584 ; selling price is $900.60 + 299.40 = \$1200$; hence, $1200 - 1109.584 = \$90.416$, the gain.

Messrs. Foote, Smith, Martin, Scripture, Corbin, Russell, Anderson, Wood, Leisy, Leahy, Wertz, Shaner, Byers, Parsons, Gunder and Proposer solved it.

702. *By the Editor.*—The length and breadth of a school-room are as 8 to 5, but if it were 2 feet longer and 2 feet wider, the area of the floor would be 1600 sq. ft. Required, the dimensions, without the aid of algebra.

By D. W. K. MARTIN, *Webster, Ohio.*

The length is to the width as 8 to 5; therefore the floor is $\frac{8}{5}$ of a square whose side equals the width of the room. But if it were 2 ft. longer and 2 ft. wider, the increase would be 4 sq. ft. at the corner

and a 2-ft. strip at the side the length of the room, plus a 2-ft. strip at the end the length of which would be the width of the room. And the length of the room being to the width of the room as 8 to 5, the side strip 2 ft. wide would equal $\frac{8}{5}$ of the end strip 2 ft. wide, and both strips = $1\frac{3}{5}$ of the end strip 2 ft. wide, or $\frac{2}{5}$ of a strip 1 ft. wide the length of which = the width of the room. Without the 4 sq. ft. at the corner the floor would consist of $1600 - 4 = 1596$ sq. ft., and would equal $\frac{8}{5}$ of a square whose side equals the width of the floor plus $\frac{2}{5}$ of a strip of the same length. Then $\frac{8}{5}$ of a square plus $\frac{2}{5}$ of a strip of the same length 1 foot wide = 1596 sq. ft.. And $\frac{5}{8}$ of this area would equal one square whose side equals the width of the room plus $\frac{5}{8}$ of $\frac{2}{5}$, or $\frac{1}{4}$ of a strip whose length equals the width of the room, and 1 ft. wide, or $\frac{5}{8}$ of 1596 ft. = $997\frac{1}{2}$ sq. ft. Consider $\frac{1}{4}$ of a strip 1 ft. wide the same as two strips each $\frac{1}{8}$ of a foot wide, and if these strips be put on two adjoining sides of the square there will lack a corner square of $\frac{1}{64}$ sq. ft. to make a full square = $997\frac{1}{2} + \frac{1}{64}$ = $64\frac{0}{4}$ sq. ft., and the side of the square = $\sqrt{64\frac{0}{4}} = 25\frac{3}{4}$ ft. and is $\frac{1}{8}$ of a foot longer than the width of the room; consequently, $25\frac{3}{4} - \frac{1}{8} = 30$ ft. width and $\frac{5}{8}$ of 30 = 48 ft. length of room.

Solved nearly thus by J. D. Hignight.

By JOHN KNIESLY, *Horatio, Ohio.*

The dimensions of the room after being increased are as 8 to 5 nearly; hence the ratio of the homologous sides of a ceiling 8 by 5 and the one required, will be the square root of the nearest square under $[1600 \div (8 \times 5)]$, or 40, which is $\sqrt{36} = 6$; therefore, $8 \times 6 = 48$ feet is the length and $5 \times 6 = 30$, the width.

A similar problem is in Ray's Higher Arithmetic, and those of us who are required to give *arithmetical* solutions plain enough for the average capacity of common school pupils, find it no easy task. Wm. Wiley adds to his elegant solution by algebra, "This problem is beyond my 'arithmetical' powers." S. G. Cagwin says, "I do not like to work algebraical problems by arithmetic," and solves it nicely by algebra. Solved also by A. M. Scripture, O. P. M. Huffman, A. L. Foote, A. G. Gunder, Wm. Tait, J. M. White and J. C. Corbin.

703. *By the Editor.*—Find solidity of a slab one foot wide and 6 ft. 9 in. long, sawed from a cylindrical log 20 inches in diameter.

By A. G. GUNDER, *Darke, Ohio.*

Altitude of triangle formed by joining center of log and edges of slab is $\sqrt{(10^2 - 6^2)} = 8$; $10 - 8 = 2$, altitude of segment. For finding the area of segment of circle we have the following rule: *Divide the cube of the height of segment by twice its base, and increase the quotient by two-thirds of the product of height and base.* Hence,

$2^3 \div (12 \times 2) + \frac{2}{3}(12 \times 2 = 16\frac{1}{3})$, area of segment.
 $16\frac{1}{3} \times 81 = 1323$, cu. in., or $\frac{1}{6}\frac{1}{4}$ cu. ft., solidity. This result is not absolutely accurate, but is approximately true.

By A. L. FOOTE, *Hempstead, Long Island.*

Let C be the center of a section of the log, $AB = 12$, width of flat side of slab and D its middle point, then will $CD = 8$ in., $\sin \angle ACD = .60000 = 36^\circ 52' 12\frac{1}{2}"$ and $\angle ACB = 73^\circ 44' 25" = 73.74027^\circ$; then sector $360^\circ : 73.74027^\circ :: \text{area } 314.6 : 64.3506756 = \text{area of sector less area of triangle} = 6 \times 8 = 48 = 16.3506756$, area of segment or end of slab; then $16.3506756 \times 81 = 1324.40725 +$ cu. in. in slab.

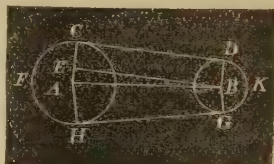
Messrs. Scripture, Harvey, Anderson, Bancroft, Davison, Ryneerson, Wood, Kniesly, Mann, Leahy, Corbin, Oliver, Shaner, Cagwin, Smith, Martin, Wiley, Gregg, Parsons and White also furnished solutions.

243. Two pulleys, one 40 inches and the other 10 inches in diameter, are 20 feet apart from center to center of pulleys. Required, the length of belt.

By MARCELLUS M. THOMPSON, *Clarksburg, W. Va.*

Let the centres of the pulleys be represented by A and B . Draw BE parallel to CD . Let $R = AC = 20$, radius of large pulley, $r = BD = 5$, radius of the smaller, $D = AB = 240$, distance apart, $C =$ circumference of the larger, and $c =$ circumference of smaller. Then the length of belt may be expressed by

$\frac{1}{2}C + \frac{1}{2}c + 2\sqrt{[(R-r)^2 + D^2]} = \frac{1}{2}(40 \times 3.1416) + \frac{1}{2}(10 \times 3.1416) + 2 \times \sqrt{(15^2 + 240^2)} = 62.832 + 15.708 + 480.936 = 559.476$ in., or 46 ft. 7.476 in.



650. How many monograms, consisting of any number of letters from 2 to 26, can be formed from our alphabet?

By A. L. FOOTE, *Hempstead, Long Island.*

If we take 6 different letters, a, b, c, d, e, f , we have

$$m \times m - 1 \times m - 2 \times (m - n + 1),$$

or $6 \times 5 \times 4 = 120$, the letters of each all different. If we take a, b, c, d, e and f twice in each group or monogram with each of the other letters in turn, we shall have six groups with 15 arrangements in each or $15 \times 6 = 90$. Then we may have 6 monograms of the same letter taken 3 times; consequently, the whole number of monograms with 6 letters taken 3 at a time, including all possible repetitions and arrangements, is $120 + 90 + 6 = 216 = 6^3$. If 2 letters had been taken,

we should have $6^2 = 36$. If 4 letters, $6^4 = 1296$, and invariably we shall have, if m be the number of letters and n the number taken at a time, $(m)^n$. Hence, in the given question, we shall have $26^2 + 26^3 + 26^4 + \dots + 26^{26} = 2,505,711,687,522,054,692,428,295,362,010,544,900$.

REMARKS BY MR. FOOTE.—If the question was how many monograms consisting of any number of *different* letters, from 2 to 26, etc., I should be willing to yield the point. But the question as stated involves the repetition of the same letter in the monograms formed, and if this be true I contend that I am right. For example, take the name, Abraham A. Appleton; we have AAA, where we have the monogram containing *three* letters, but if the wording of the question had been *different* letters, it would contain but one. I fail to see how the result can be otherwise.

Problems for Solution.

The following 8 problems are by *request* of different readers who desire elementary work.

718. By making 2% more on sales, A gains \$100 more per annum than B. If each has \$5940 at the close of a year's business, determine their rate of gain and each one's annual profits.

719. A and B rent 12 acres of pasture for 8 weeks, paying \$90. A is to pay for the grass already on the field and B. for what grows during time of pasture. How many cattle can each turn in, if 4 acres together with what grows during time of pasture, would keep 12 oxen 6 weeks, and similarly five acres would keep 32 oxen 2 weeks?

720. A calendar clock has a month, day, hour, minute, and second hand. All these hands are together at noon, Jan. 1, 1885; when will they be together again?

721. A cistern can be filled in 2 hr. 8 min. by a pipe $\frac{5}{8}$ of an inch in diameter. In what time can it empty the cistern if a half-inch pipe be running into the cistern at the same time?

722. If 4 men saw 15 cords of oak in the same time 5 men saw 14 cords of hickory, and if 3 men saw 18 cords of hickory in 3 days at 12 hours each, how many hours a day must 7 men work to saw 90 cords of oak in 6 days?

723. A ladder 10 feet long stands close against a vertical wall. If the lower end is drawn out and the upper slides down the wall until the ladder assumes a horizontal position, through what distance will the middle point move?

724. How many balls in a pile whose base is a square, with 20 on each side?

725. A boy starts from G for L at the same time a man starts from L for G. Each travels at a uniform speed and they meet at noon. The boy reaches L at 5 P. M. and the man arrives at G at 12 min. past 7 P. M. When did they start?

726. By B. F. FINKEL, *Commercial Point, Ohio*.—There is a row of perfectly elastic balls in a geometrical progression, whose common ratio is 3; the first impinges on the second which transmits its velocity to the third, and so on; the last ball moves off with $\frac{1}{3^4}$ of the velocity of the first. Required, the number of balls.

727. *By the same*.—Find the edge of the largest possible cube that can be cut from a hemisphere 6 inches in diameter.

728. *By the same*.—Find the base and perpendicular of a right-angled triangle, having given the hypotenuse = 35 ft. and the side of inscribed square = 12 ft.

729. By PROF. H. A. WOOD, *New York*.—Show that the area of a regular inscribed dodecagon is equal to three times the square on the radius.

730. By N. R. OLIVER, *Dorchester, Ont.*—The diameter of the circumscribing circle of a right triangle added to the diameter of the inscribed circle is $71\frac{3}{4}$, and the perpendicular is $\frac{3}{4}$ of the base; required the sides without the application of algebra.

[Continued on page 63.]

Examination Questions.

NOTE.—Seventy-seven applicants were examined on this list April 4. Of the 96 applicants at previous examination 45 received certificates and 51 failed. We omit solutions to the arithmetic and answers to easy questions in geography and grammar, as our readers are able to supply these themselves.

ARITHMETIC.

1. Define and illustrate evolution and involution.
2. What per cent. of $\frac{1}{2}$ of $\frac{5}{4}$ of $\frac{3}{8}$ is $\frac{1}{3}$? *Ans., 20%.*
3. In what time will \$480 at $4\frac{1}{2}\%$ amount to \$561.60? *Ans., 3 yr. 9 mo. 10 da.*
4. Change $\frac{1}{2}\frac{7}{10}$ to a fraction whose numerator shall be 34. *Ans., $\frac{34}{46}$.*
5. At what premium are 5% bonds to yield 4% on the investment? *Ans., 25%.*
6. Required the wall-surface of a square room, whose sides are each 16 ft. long and 10 ft. high. *Ans., 640 sq. ft.*
7. Bought a carriage for \$123.16, which was 16% less than I paid for a horse. How much was paid for the horse? *Ans., \$146.619.*
8. Bought cloth at \$5. What must be the asking price, in order to fall 10%, and still make 10% on the purchase? *Ans., \$6 $\frac{1}{9}$.*
9. If a globe of gold 1 inch in diameter be worth \$120, what is the value of a globe $3\frac{1}{2}$ inches in diameter? *Ans., \$5145.*
10. If a body moves 40 feet the first second, 20 feet the next, 10 feet the next, and so on forever, over what distance does it move? *Ans., 80 ft.*

GEOGRAPHY.

1. Into what three branches is geography divided? Define each.
2. Define climate and give a full description of the climate of Europe.
3. To what three great movements is the ocean subject? State the cause of each.
4. Bound the zones and give the width of each in degrees.
5. Name the largest river and largest city of each Grand Division.
6. What two empires lie partly in Europe and partly in Asia?
7. Why is it warmer in this latitude in June than in December?
8. What and where are the following: Belgrade, Corea, Tananarivo, York and Tsad?
9. Name in order of their size the five largest cities in the United States. Also the three largest in Ohio.
10. Begin at the north and name the western tier of counties in Ohio giving the county seat of each.

HISTORY.

1. Name the first and present president of the U. S. Tell when each was inaugurated. Name the members of each cabinet.

Ans.—(1) Washington, inaugurated in New York, Apr. 30, 1789. Robt. R. Livingston administered the oath. For cabinet, see Jan. *Visitor*, p. 13. (2) Cleveland, inaugurated at Washington, March 4, 1885. Cabinet—Thomas Francis Bayard, Sec'y of State; Danl. Manning, Sec'y of Treasury; William Crowninshield Endicott, Sec'y of War; Wm. Collins Whitney, Sec'y of Navy; Lucius Quintus Curtius Lamar, Sec'y of Interior; Wm. Freeman Vilas, P. M. General; Augustus H. Garland, Attorney General.

2. What led to the impeachment of Andrew Johnson? Who conducted the impeachment trial?

Ans.—When Johnson vetoed the Bill granting the right of suffrage to the colored men in the District of Columbia, Mr. Ashley, representative from Ohio arose and presented a resolution that President Johnson be impeached. This was done Jan. 7, 1867. But the judiciary committee of the House did not feel warranted in proceeding. Aug. 12, Sec'y Stanton of the War Department, who had retained his office in spite of Johnson's disagreement, was removed in violation of the tenure-of-office act, and Gen. Grant was appointed in his place. Mr. Stanton passed over the office, under protest. Feb. 21, 1868, the conflict between the president and the congress was intensified by another attempt of the former to remove Stanton, and to appoint Gen. Lorenzo Thomas. Mr. Stanton would not give up the office and told Mr. Thomas to confine himself to his own sphere as adjutant general. Feb. 24, the House voted to impeach Mr. Johnson. There were eleven charges preferred, but the impeachment court organized by the senate March 5, and lasting till the 16th, in which chief-justice Chase presided, acquitted him. The vote stood 35 for conviction and 19 for acquittal.

3. Name the states that were formed from the North West Territory giving date of admission for each.

Ans.—Ohio, Nov. 29, 1802; Indiana, Dec. 11, 1816; Illinois, Dec. 3, 1818; Michigan, Jan. 26, 1837; Wisconsin, May 29, 1848.

4. When was slavery introduced into the U. S.? When abolished?

Ans.—In 1501 a royal ordinance was passed permitting Spanish emigrants to the New World to take with them negro slaves which had been born among christians. But not till in August, 1620, was slavery introduced in the English colonies. Abolished Jan. 1, 1863.

5. What was the Dred-Scott Decision? The Fugitive Slave Law?

Ans.—(1) Dred Scott was a slave who had lived 4 years with his master in Illinois, and afterward a while in Minnesota. He was carried back to Missouri and whipped. He entered suit against his master, pleading that he had become free by having lived in two free states. He won his case in the Missouri Circuit Court, but on appeal to the U. S. Supreme Court, Roger B. Taney being chief-justice, it was decided by this body March 6, 1857, that negroes in slavery were chattels, had no rights which white people were bound to respect, could be taken anywhere. (2) It was a part of Henry Clay's Omnibus Bill, and by its provisions an escaped slave could be taken anywhere, and attached a penalty to any one aiding in the escape of a fugitive.

6. Name two of the most important events of Jefferson's administration.

Ans.—Purchase of Louisiana and the Tripolitan War.

7. How is the number of electors from each state determined? Which state has the most? How many?

Ans.—By the number of representatives in congress. New York has 36.

8. How are state senators chosen? U. S. senators?

Ans.—By the people. By the state legislatures.

9. Who was the first and who is the present Chief Justice of the U. S.? What is the length of term of that office?

Ans.—John Jay, of New York, 1789-95. Morrison R. Waite, of Ohio, 1874—. For life or during good behavior.

10. During the late Rebellion how many states seceded? Which state seceded first?

Ans.—Eleven. South Carolina, Dec. 20, 1860.

SPELLING.

Inscrutable, teachable, tripartite, theodolite, bissertile, sheathe, accomplice, fictitious, jocular, amphitheater, egregious, duplicity, spontaneous, inexplicable, tabernacle, pinnacle, tumultuous, horticulture, granular, ambiguous.

GRAMMAR.

1. Define: Parsing, Syntax, Ellipsis, Government, Agreement.

2. Write the plurals of *hero*, *duty*, *beau*, *court-martial*, *vermin*.

Ans.—Heroes, duties, beaux, courts-martial, vermin.

3. Write the feminine corresponding to *wizard*, *earl*, *testator*, *priest*, *songster*.

Ans.—Witch, countess, testatrix, priestess, songstress.

4. What are the signs of the potential mode? Give a synopsis of the verb *go* in this mode.

5. What kind of verbs do not commonly assume the passive form? Why?

Ans.—Intransitive verbs, from their nature, can not regularly be used in the passive form.

6. Give the two general classes into which connectives are divided. Define each.

7. Give five rules for the use of the comma. Five for the use of capitals.

8. What is a complex element of the third class? Give example.

9. Diagram:—

When *Music*, heavenly *maid*, was young,
While yet in early Greece she sung,
The Passions *oft*, to hear her shell,
Thronged around her magic *cell*.

(	passions		the	{	music		maid		heavenly
					was-young				
(	thronged		she	{	]		when		
					yet				
(	thronged		she	{	sung		in Greece		early
					oft		while		
(	thronged		she	{	to hear		shell		her
					around cell		her		
(	thronged		she	{					

10. Parse the italicized words in the above.

From page 59.

731. By L. A. REED, *Cleveland, Ohio*.—Two men and a boy engaged to dig a field of potatoes for \$10. The boy could pull the vines as fast as the two men could dig the potatoes, but either of the men could pull the vines $\frac{1}{3}$ faster than the other man and boy could dig them; how must they share the money?

732. By A. L. FOOTE, *Hempstead, Long Island*.—A set out from C towards D and traveled 7 miles an hour. After he had gone 32 miles, B set out from D towards C, and went each hour $\frac{1}{19}$ of the whole distance; and after he had traveled as many hours as he went miles an hour, he met A. Required the distance between the two places.

733. By T. L. BREWER, *Mt. Heron, Ohio*.—A piece of elm weighs 15 lbs. in open air. A piece of copper, which weighs 18 lbs. in air and 16 lbs. in water, is attached to it, and the compound weighs 6 lbs. in water. What is the specific gravity of the elm?

734. By W. L. HARVEY, *Marfield, Me.*—It is required to divide the base of an obtuse angle triangle into two parts, so that a line from the obtuse angle will be a mean proportional between the segments.

735. By GEO. L. SHANER, *Stewart's Station, Pa.*—The interest of the sum of $\frac{1}{2}$ of A's fortune, $\frac{2}{3}$ of B's, and $\frac{3}{4}$ of C's fortune, for a certain time, at $2\frac{1}{2}\%$, was to this sum as 9 to 200; and the amount of this interest for $6\frac{2}{3}$ times as long, at 5 times as great a per cent., was \$945. What was the fortune of each, provided A's fortune was to B's as 1 to 3, and B's to C's as 9 to 4, and how long was the first on interest?

736. By IRA S. WOLCOTT, *Lykens, Pa.*—Find two numbers such that the difference of their squares shall be a cube and the difference of their cubes a square number.

737. By J. C. CORBIN, *Pine Bluff, Ark.*—To plant nineteen trees so that they shall constitute nine straight rows with five trees in each row.—*Welch's Geometry*.

Solutions should be received on or before May 5.

Editorial Notes.

W. L. Harvey solved Prob. 676 and P. W. Byers Prob. 693.

We received a partial answer to query 573 from Prof. N. B. Webster, and in the next issue we will publish his complete answer.

J. Womelsdorf, of Beech Creek, Pa., sent answers to queries 552, 562, 564 and 572, which came too late for credit on page 71.

S. G. Cagwin, sent solutions of Probs. 558, 664, 690, 696 and 700, which were received April 7, and too late for credit or publication.

We have received *Manson's Economic Spelling Blank*, for written spelling with pen or pencil. Sufficient space for 14 weeks or 1440 words with corrections. It is a good thing. Price 45 cts. a dozen. Address Ivison, Blakeman, Taylor & Co., Chicago or New York.

W. I. Brenizer informs us that his authority for the weight of Webster's brain (53.5 oz.) is *Eclectic Physiology*, p. 105, and for weight of Cuvier's brain (64.5 oz.) same reference as above and *Gray's Anatomy*, p. 610. Mr. Brenizer will please accept our thanks for this kind favor.

ERRATA.—The figure to A. M. Scripture's solution of Prob. 681, p. 30, was adapted from one previously engraved, and the circle should be circumscribed instead of inscribed. In changing the notation in the solution, we inadvertently wrote *BF* instead of *HF*, which please correct in line 2 of said solution.

H. Lenich Meyer, of Strasburg, Pa., E. J. Griffis, of Ada, Ohio, Winnie Crider, of Greenville, Ohio, Grant Sheller, of West Sonora, Ohio, and O. P. Wilcox, of German, Ohio, have lately formed clubs for the *Visitor*. We tender these good friends our hearty thanks for their kind favors. We can still supply back numbers of this year.

QUERIES.

1. *The Roundhead's and the Parliament's* forces were soon engaged. Parse all italicized words, and explain difficulties.
2. *The more I sing the better I like it.*
3. O bosom, black as death!
O limed soul! *that struggling to be free,*
Art only more engaged. Help, Angels, *make assay!*
Bow stubborn knees! and heart with strings of steel,
Be soft as sinews of the new-born babe.
4. When an article precedes the possessive case does it limit the the noun in the possessive case? J. W.

PARTICIPLES.

The participle may have the construction of an *adjective* or *noun*. The following examples should be carefully studied by the learner. The word modified by the participle is italicized.

CONSTRUCTION OF AN ADJECTIVE.—1. *Lulled* in the countless chambers of the brain, our *thoughts* are strangely linked. 2. A diphthong is two *vowels joined* in one syllable. 3. *Hands* of angels, *hidden* from mortal view, shifted the scenery of the heavens. 4. The *teacher* was full of enthusiasm, always *willing* to aid in any good work. 5. *Stormed* at with shot and shell, boldly *they* rode, and well. 6. *She came tripping* lightly through the aisle. 7. The *crowd* stood on the deck *facing* the storm. 8. Then came *wandering* by, a shadow like an angel. 9. For some time *Rip* lay *musings* on the scene. 10. I confess *myself* wholly *convinced* by his argument. 11. The old *man* sat by the hearth, *smoking* his pipe. 12. Fiery *isles* spring *blazing* from the mighty deep. 13. That *rock* is *being* gradually *worn* away. 14. The *company* sat *enjoying* a social chat. 15. *Esteeming* themselves wise, *they* became fools. 16. After *defeating* my opponent, *I* left the room. 17. Van Twiller sat in a huge *chair* of solid oak, *heven* in the celebrated forest of the Hague. 18. The *philosopher* sat *buried* in thought. 19. *He* rushed along, *stumbling* over the chairs. 20. The *teacher* acted too hastily, *being* entirely *overcome* by passion.

PARTICIPIAL ADJECTIVES.—1. I heard an *amusing* joke. 2. A *rolling* stone gathers no moss. 3. The *waving* banner was seen. 4. The *alleged* crime was soon forgotten. 5. A *written* excuse was required by the *doubting* teacher.

NOTE.—These should be parsed like adjectives, and are distinguished from the participle by not retaining the idea of time in the assumption of action or being.

CONSTRUCTION OF A NOUN.—1. We profit *by doing* good. 2. Your *writing* that letter *secured* his friendship. 3. You *should avoid injuring* the feelings of others. 4. I heard *of their being* surprised. 5. He *should consider* killing birds a wicked sport. 6. My favorite *exercise, jumping* the rope, was stopped. 7. Some books are not worth [] *reading* through. 8. His efforts at progress are *like walking* in the sand. 9. My *being* sick was *not reported* in the paper. 10. The boy's *being* supplied with plenty of books *gave* him an advantage over others. 11. They *commenced* plowing a 30-acre field. 12. Grouchy's *being* behind time *decided* the battle of Waterloo. Telling is *not teaching* (pred.). His business is *selling* (pred.) books.

PARTICIPIAL NOUNS.—1. The *inflicting* of corporal punishment is desirable. 2. A little *laughing* followed the scene. 3. All knees were bent in fervent *thanksgiving*. 4. The minister omitted the *reading* of the scripture lesson. 5. The *chewing* of tobacco is a bad habit. 6. We heard the *howling* of the wolves before the *coming* of the storm.

NOTE.—Parse these like nouns. They are distinguished from the participle in being limited by *the, an, or a*, and thus rejecting the governing of an object.

INFINITIVES.

We have been asked, quite frequently, to give examples of the different constructions of the infinitive for the use of the teacher or learner. Our grammars give so few illustrative examples, that we consider it highly valuable for the learner to have special drills like the following, which we have often given in the class room. Exercises like these should be written on the board without classification for the pupils to determine the construction. The infinitive may have three constructions; that of *noun*, *adjective*, or *adverb*. In these examples, we italicize the word upon which the infinitive depends.

CONSTRUCTION OF AN ADVERB.—1. Fortune came to smile on us. 2. I begin more and more to feel that teaching is my calling. 3. They all hastened to come to help. 4. He was eager to learn. 5. He endeavored earnestly to do his duty. 6. I determined early in the morning to see the parent. 7. I dare do all that work. 8. You need not come. 9. I am unable to learn the lesson. 10. The prisoner was seen by several to commit the act. 11. I began to move. 12. She need dig no more. 13. I felt afraid to stir. 14. He bids fair to make a good scholar. 15. I felt willing to let the girls enjoy (adj.) themselves. 16. I will pay you a dime to take me to the depot. 17. A pupil anxious to get through the book is apt to have a superficial knowledge. 18. He was too proud to apologize. 19. Hope comes with smiles the hour of pain to cheer. 20. To curb his emotions, he sat on the curbstone for ten minutes. 21. They meet but to part. 22. The pupil is old enough to know better. 23. They concluded to go to hear the orator speak (adj.). 24. Darest thou then to beard the lion in his den?

CONSTRUCTION OF AN ADJECTIVE.—1. Would you have us reject him? 2. It is wrong for you to forsake us. 3. John has a house to sell. 4. In that quarrel he is to blame. 5. I feel the pain abate. 6. I dare you to do it. 7. Bid me come to you. 8. We heard the old man of the crowd say a harsh word. 9. Would they have us go? 10. He dared them to fight. 11. The officer ordered the bridge to be broken down. 12. Did you observe it move? 13. You would scarce expect a person of my age to speak in public. 14. We saw the light of the lonely hermit gleam through the forest. 15. His promise to help us was broken. 16. She had the sense to refuse the offer. 17. He let fly a stone. 18. He confessed himself to be in fault. 19. The marshal ordered his horse to be brought. 20. He is to be promoted. 21. The ship is to sail² to-morrow. 22. The goods are to be sold² at auction. 23. The luke is said to be² a thousand feet deep. 24. Their object seems to be² to hold² a caucus. 25. It is greatly to be deplored. 26. The champion was to have been rewarded². 27. The debtor is said to have absconded². 28. I felt something come over me.

CONSTRUCTION OF A NOUN.—1. To obey¹ is to enjoy². 2. To confess⁵ the truth, I was guilty. 3. I dread to see³ him. 4. I found it to no purpose to buy⁴ the toy. 5. He has to study³ half of the night to get (adverb) his lessons. 6. It is difficult to correct⁴ bad habits. 7. For a pupil to cheat¹ at examination is base. 8. It is wrong for her to act⁴ thus. 9. The noblest revenge is to forgive². 10. The prisoner attempted to escape³. 11. The teacher taught me how to parse³. 12. He knows not how to study³. 13. To be⁵ candid, I was in error. 14. To lore¹ to teach³ is essential to success. 15. The train is about to leave³. 16. He does nothing but find³ fault. 17. He had to pay³ the debt. 18. They had dared to think³ for themselves. 19. Samuel needs to be encouraged³ in his studies. 20. Tell [to] him not to tease³ the child. 21. I told him when to come³.

NOTE.—The superiors in the above signify as follows: ¹=subject; ²=in the predicate, referring to the subject; ³=object; ⁴=in apposition; ⁵=used independently.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

620. A friend writes: "In *Visitor*, Vol. 5, No. 8, the center of population in the U. S. is given near Cincinnati. How is this point determined?"

Ans.—Take the census report and maps, add the population from east to west, advancing from one meridian to another with solid front, until you find the meridian that divides the country into two parts having equal population. Similarly, by parallels you determine the line that divides it into northern and southern sections. At the intersection of these lines is the required center.

EDITOR.

621. A boy sends the following mathematico-theological problem for solution:

"How many apples did Adam and Eve eat? Some say Eve 8 and Adam 2, making a total of 10. Others figure it differently, Eve 8 and Adam 8 also, = 16; but if Eve 8 and Adam 82, then the total is 90. Scientific men erroneously reason thus: Eve 81 and Adam 82, which gives 163. My classmate argues—if Eve 81 and Adam 812, total will be 893. Finally, my teacher puts it—Eve 811st and Adam 812, = 1,623. Is he right?"

Ans.—We agree with your teacher, that if Eve ate one first, and Adam ate one too, then both *** guilty.

EDITOR.

622. Who are the present rulers of Montenegro, Roumania, Serbia, and Bulgaria?

P. C.

Ans.—King Nakita, King Charles, King Milan, King Alexander.

623. Who constituted the committee on arrangement for the treaty of Paris at the close of the Revolutionary war?

Id.

Ans.—John Adams, John Jay, Benj. Franklin and Henry Laurens in behalf of the U. S.; Messrs. Oswald and Fitzherbert for England.

547. Whence come the oft-quoted lines:—

"Though the mills of God grind slowly, yet they grind exceedingly small."

"The power behind the throne."

"To sow one's wild oats."

And what do they severally mean?

C. H.

Ans.—The original idea of the first comes from an ancient apothegm, in *Oracula Sibyllina*, a collection made up from Pagan and Christian sources, and issued at Basle in 1545. "At length God's mills grind the flour fine," was the original, arranged by Logan, a Silesian writer, and used in one of his poems, which Longfellow translated as given in query. It may be found in Longfellow's *Poetical Aphorisms*, by the name of *Retribution*. The second quotation was first used by Wm. Pitt, in his speech March 2, 1770, when he said, "A long train of these practices has at length unwillingly convinced me that there is something behind the throne greater than the king himself." The third is figurative, comparing the bad habits and the foolish pranks of youth to wild oats, when the desired product of life's field of action should be a steady purpose and a noble bearing.

EDITOR.

548. How many called sessions of Congress have been held? Give dates and causes.

Id.

Ans.—Soon after John Adams's inauguration, in 1797, the French government became excited by his election, and authorized the capture of American vessels declaring that all American sailors found therein should be hung. Adams called a session of Congress to meet March 15, on account of this threatened war. Hayes, in the spring of 1879, called an extra session of Congress to make the necessary appropriations for the support of certain branches of the government, which the deadlock in Congress and finally the President's veto prevented during the regular session. EDITOR.

549. Who is meant in Whittier's *Snow Bound* by "Siena's Saint" and the "Crazy Queen of Lebanon"? Id.

Ans.—St. Catherine, who flourished in Siena, a city of central Italy, and who, it is said, possessed wonderful spiritual powers. The "Crazy Queen of Lebanon" alludes to Lady Hester Stanhope, an eccentric English woman, who was the daughter of the Earl Stanhope, born in London, 1766. She was a niece of Wm. Pitt, the statesman, with whom she resided from the age of twenty to the time of his death, 1806. She lost her mother in infancy, and being homeless and apparently forsaken after her uncle died, she abandoned England in disgust (1810), and followed a career of Oriental adventure. In Syria she excited the admiration of the natives, who deemed her a queen. For many years she resided on or near Mt. Lebanon, with a large retinue of subjects, acquiring great prestige as a magician and mistress of mystical lore. EDITOR.

Answered by D. W. K. Martin.

550. Name and locate all the historical trees in the U. S. Id.

Ans.—The *Elm Tree* at Philadelphia, at which Wm. Penn made his famous treaty with nineteen tribes of barbarians.

The *Charter Oak*, at Hartford, which preserved the written guarantee of the liberties of the Colony of Connecticut.

The wide-spreading *Oak of Flushing*, Long Island, under which George Fox, the founder of the Society of Friends or Quakers, preached.

The lofty *Cypress* in the Dismal Swamp, under which George Washington reposed one night in his young manhood.

The huge *French Apple Tree*, near Ft. Wayne, Ind., where Little Turtle gathered his warriors.

The *Elm* at Cambridge, under which Washington took command of the Continental Army on a hot summer's day.

The *Tulip Tree* on King's Mountain battlefield in South Carolina, on which ten bloodthirsty Tories were hung at one time.

The tall *Pine* at Ft. Edwards, N. Y., under which the beautiful Jane McCrea was slain.

The magnificent *Black Walnut Tree*, near Haverstraw, on the Hudson, at which Gen. Wayne mustered his forces at midnight, preparatory to his gallant and successful attack on Stony Point.

The grand *Magnolia Tree*, near Charleston, S. C., under which Gen. Lincoln held a council of war previous to surrendering the city.

The great *Pecan Tree* at Villere's plantation, below New Orleans, under which a portion of the remains of Gen. Pakenham was buried.

The *Pear Trees* planted, respectively, by Gov. Endicott, of Mass., and Gov. Stuyvesant, of N. Y., more than two hundred years ago.—*Benson J. Lossing.*

The *Burgoyne Elm* at Albany, N. Y., planted the day after the surrender, when Burgoyne was brought into Albany a prisoner.

The *Weeping Willow* in Cop's burying-ground, near Bunker Hill. This willow, grown from a branch taken from a tree that shaded the grave of Napoleon, at St. Helena, now waves over that of Cotton Mather, so noted in Salem witchcraft.

The *Ash Trees* planted at Mt. Vernon by George Washington.—J. B. Peaslee's "Trees and Tree-Planting." T. J. BARNES.

551. Why did the French in Canada extend their explorations westward to the Mississippi rather than southward into New York?

Ans.—Samuel Champlain established a trading post at Quebec in 1608. The next summer, in his eager desire to explore the country, he joined a war party of the Hurons against the Iroquois, or Five Nations of Central New York. This interference of Champlain with the Indians secured the inveterate hostility of the Iroquois tribes. Not long after, they seized the missionaries who came among them, tortured, and put them to death. This cut off any farther explorations toward the south. The French, therefore, turned their attention toward the west.—*Barnes.*

J. H. W. SCHMIDT.

552. In what battle did both generals mass their strength on the left wing, expecting to crush the enemy's right?

Ans.—The battle of Murphreesborough, Dec. 31, 1862. D. W. K. MARTIN.

553. Who is the author of the familiar lines,

Thirty days hath September, etc. T. J. UPDYKE.

Ans.—It is supposed that Richard Grafton, an English printer and historical writer of the 16th century, composed these familiar lines. J. H. W. SCHMIDT.

554. Who is the originator of the "Theory of Limits"? *Id.*

COMMENT.—We think Newton has the credit of introducing the method of limits, especially in his later investigations. EDITOR.

555. Please state Prop. 5, Book I. of Euclid, known as the "Pons Asinorum." *Id.*

Ans.—The angles at the base of an isosceles triangle are equal; and if the equal sides are produced, the angles on the other side of the base are equal.

WM. TAIT.

557. Name all the congressmen from Ohio.

Id.

Ans.—Senators—Sherman and Pendleton. Representatives—District No. 1, B. Butterworth, R.; No. 2, Chas. E. Brown, R.; No. 3, J. E. Campbell, D.; No. 4, C. M. Anderson, D.; No. 5, Benj. LeFevre, D.; No. 6, Wm. D. Hill, D.; No. 7, Geo. E. Seney, D.; No. 8, John Little, R.; No. 9, Wm. C. Cooper, R.; No. 10, Jacob Romeis, R.; No. 11, W. W. Ellsberry, D.; A. C. Thompson, R.; No. 13, J. H. Outhwaite, D.; No. 14, C. Grosvenor, R.; No. 15, B. Wilkins, D.; No. 16, Geo. W. Geddes, D.; No. 17, A. J. Warner, D.; No. 18, Isaac Taylor, R.; Ezra B. Taylor, R.; No. 20, Wm. McKinley, R.; No. 21, M. A. Foran, D.

D. W. K. MARTIN.

559. What public school in the United States supports the greatest number of teachers?

Id.

COMMENT.—The query is rather indefinite. If we are to consider the system of graded schools in our cities as a unit, then we can easily answer. If not, and colleges, normal schools, city ward schools, etc., are to be taken into consideration, the answer can not be easily given.

EDITOR.

560. Name the portraits on the several denominations of U. S. postage stamps.

WM. S. DAVIDSON.

Ans.—The 1-cent stamp bears the head of Franklin, from a profile bust by Rubright; the 2-cent that of Washington after Houdon's bust; the 4-cent that of Jackson; the 5-cent that of Garfield; the 6-cent that of Lincoln after a bust by Volk; and the 10-cent that of Jefferson, drawn from the life-size statue by Hiram Powers.

D. W. K. MARTIN.

561. Tell what circular numbers are.

Id.

Ans.—Circular numbers are those whose powers terminate in the same digits as the roots themselves; as 5, 6, and 25, whose different powers always end with 5, 6, and 25.

ED. RYNEARSON.

562. State why the Amazon River, Catskill Mts., Little Rock, Crown Point and Patagonia were so named. *Id.*

Ans. Amazon, from *Amassona* the Indian name signifying "boat destroyer" in allusion to the great height and violence of the tide. It was named Amazon, from the companies of women in arms which were seen on the banks: Probably the Indian name of the river may have suggested the fable of the Amazons. Catskill Mts. were so called from the panthers and lynxes which formerly infested them. Crown Point was so named because "scalping parties" were sent out from this place by the French and Indians. Little Rock is so named from the fact that it is built on a low bed of rock (little rock) 2 miles below a range of cliffs on the opposite bank 400 or 500 feet high called Big Rock. Patagonia is derived from the Spanish *patagon*, a large foot, and was so named by Magellan from a mistaken idea of the large size of the native's feet, which are in fact comparatively small. D. W. K. MARTIN.

Little Rock is named from a rock on the river bank just at the city, the first rock that occurs in ascending the river. Big Rock is quite a hill directly opposite the city. We natives always pronounce the name of our capital thus, Littlerock, as one word, with the accent on the first syllable. J. C. CORBIN.

563. Give author of the speech named, "Mausoleum of Hearts." *Id.*

Ans.—The "Mausoleum of Hearts" was a speech made by ex-President Pierce. J. H. W. SCHMIDT.

564. Define isoclinal, isogonic and isothermal lines. *Id.*

Ans.—Isogonic lines are lines traced on the surface of the globe connecting places at which the deviation of the magnetic needle from the meridian or true north is equal. Isoclinal lines are lines on the earth's surface connecting places at which a dipping needle indicates the same inclination or dip. Isothermal lines are those passing through places having the same mean summer temperature.—Webster's *Unabridged Dictionary*. JOHN H. KNIESLY:

565. What state pays its governor the highest salary?

GEO. L. SHANER:

Ans.—New York and Pennsylvania each pays the Governor \$10,000 a year: GEO. H. THOMAS:

566. Name the "City of the Violet Crown." *Id.*

Ans.—Athens, Greece. See Webster's *Unabridged Dictionary*.

HOMER M. KNOWLES:

567. Give a sketch of the poet called the "Ettrick Shepherd." *Id.*

Ans.—James Hogg (1772-1835) lived in the Ettrick Forest, Leicestershire, Scotland. He left school at eight years of age and became a shepherd. He was second only to Burns among the Scottish Peasant Poets. His first work appeared in 1801 and he followed this up rapidly. His finest work was *The Queen's Wake*, published in 1813. With the proceeds of some of his writings he took a farm but this proved a failure, and in 1810 he began a regular course of authorship. He married in 1814, and again lived on a farm given him by Buccleuch, but he found his pen more profitable. His poetical works are *Madoc of the Moor*, *The Pilgrims of the Sun*, *The Jacobite Relics of Scotland*, *Queen Hynde* and *The Border Garland*. The best of his prose works are *The Brownie of Bodsbeck*, *Winter Evening Tales* and *The Three Perils of Man*.

T. J. BARNES.

568. State the provisions of the Nicaragua Treaty, of Nov. 1884.

COSMOS.

Ans.—This Treaty authorizes the construction by the U. S. of a canal and telegraph line across the Nicaraguan territory. By its terms 60 miles of the river San Juan, as well as Lake Nicaragua, an inland sea 40 miles in width, are a part of the projected enterprise. This leaves for actual canal construction 17 miles on the Pacific coast and 36 miles on the Atlantic coast. The U. S. Senate has recently rejected this treaty and the serious objections to the scheme will no doubt lead the public to concur with the Senate that the treaty should be set aside. In a financial point of view it would hardly pay the U. S. to undertake the immense work. This canal including the harbors at Brito and Greytown would cost about \$100,000,000.

EDITOR.

569. Is there a canal across the Isthmus of Panama? of Tehuantepec?

Id.

Ans.—There is no canal across Panama at present, but one is in process of construction. There is none across Tehuantepec.

O. P. M. HUFFMAN.

570. It has been computed by ancient astronomers that the obliquity of the earth's ecliptic has been decreasing for 20,000 years, and will continue to decrease a number of years longer; after this it will begin to increase and return to its former position. How long will it be?

S. G. C.

Ans.—“As the motion of the equator which produces the precession of the equinoxes is uniform, the motion of the pole is uniform also; and as the pole will accomplish a revolution in the same time with the equinox, its rate of motion must be the same as that of the equinox, that is 50" of its circle in a year. The period of revolution of the equinox and the pole of the equator, is about 24500 years.”

It is an interesting consequence of this motion of the pole of the equator and heavens, that the pole-star so called will not always be nearer to the pole than any other star. The pole is at present approaching it, and will continue to approach it, until the present distance of $11\frac{1}{2}^{\circ}$ becomes reduced to less than $\frac{1}{2}^{\circ}$ which will happen about the year 2100, after which it will begin to recede from it, and continue to recede, until about the year 3200, when another star will come to have the rank of a pole-star.” See Norton's *Astronomy*, 5th ed., p. 87, art. 118.

WILLIAM HOOVER.

571. Who was Leggett? and where is his monument? G. P.

Ans.—He was an American journalist and miscellaneous writer, born in New York in 1802. “Two volumes of his political writings, with a memoir, were published by his friend, Mr. Theodore Sedgwick, who says in his preface, ‘it is not the suggestion of a too fond affection, but the voice of a calm judgment, which declares that whatever public career he had pursued, he must have raised to his memory an imperishable monument’.”—*Lippincott's Biographical Diet.*—which leaves something on which to exercise the imagination of the reader.

W. H.

572. State the loss sustained by both armies in the battle of Trenton, Dec. 25, 1777.

Id.

Ans.—Ridpath states that the commander, Col. Rahl, fell at the first onset, mortally wounded, and forty or fifty others fell before the volleys of the patriots. At the first alarm about six hundred light horse and infantry had escaped toward Bordentown. All the rest were made prisoners of war, which were about one thousand. The Americans lost four men—two killed and two frozen to death.

ED. RYNEARSON.

The Hessians lost 1000 prisoners, 6 brass field pieces, 1200 stand of arms, the standards of an entire brigade, and 17 killed. The Americans did not lose a man in the fight, but two were frozen to death in recrossing the river.

W. C. BINKLEY.

574. Are persons so organized by nature that they instinctively take a vicious course?

M. C. MYERS.

Ans.—We have evidences in scripture of natural insanity [Psalm 58-3], and it seems that some persons possess such strong tendencies to wickedness, or to a perverted action of the animal propensities, that they do not live right and are morally unsound, unbalanced, insane. There are physical cripples, intellectual imbeciles, and we are inclined to think that vice is sometimes inborn and not merely the result of bad associations.

EDITOR.

575. What Lord Mayor of London, in the 14th century, was noted as a public benefactor, and who got his start in business life by the sale of his extraordinary cat? Give incident.

Id.

Ans.—It must have been Sir Richard Whittington, the hero of this English legend. He was a poor country lad who secured a position in a merchant's family in London as cook's scullion. Here he led an unhappy life, as he was abused by the cook and had to sleep in a garret that was infested with rats and mice. He therefore purchased a cat with his scanty earnings, and the nocturnal intruders soon ceased their torment. Soon after, his master having loaded a ship with a cargo for the East, gave the servants a chance to send something to sell as a trial of fortune. Whittington sent the cat, his only property. The ship was driven by storm to the coast of the Barbary States, where the officers were kindly received, and invited to dine with the king. When at the table the rats and mice invaded the room, and greatly annoyed the company. The captain sent for Whittington's cat, which soon made such a fierce assault on the vermin that they were completely driven out. The king was so highly pleased with the cat's performance, that he offered a high price and secured it. The money started Whittington in business; he succeeded remarkably well, married his old master's daughter, was knighted by the king, and finally became Lord Mayor of London. See "Life of S. R. Whittington, London, 1811."

EDITOR.

577. Give a brief sketch of the "Jetty System."

W. H. HAMILTON.

Ans.—Jetties are embankments or piers extending into the sea, and built of earth, stone, fascines, timber, or other suitable material, either singly or combined. Jetties are applied to rivers and tidal harbors, to increase the depth over bars by narrowing the channel, and thus concentrating the current.

J. H. W. SCHMIDT.

CREDITS.

- T. J. BARNES, *Bevis, Ohio*, 549, 555, 561, 562, 564, 566.
 J. H. W. SCHMIDT, *Columbus, Ohio*, 550, 552, 555, 561, 566, 567.
 GEO. L. SHANER, *Stewart's Station, Pa.*, 551, 552, 572.
 D. W. K. MARTIN, *Webster, Ohio*, 551, 564, 565, 566, 567, 572.
 WM. HOOVER, *Athens, Ohio*, 561.
 GEO. H. THOMAS, *German, Ohio*, 561, 564, 566.
 W. C. BINKLEY, *Cincinnati, Ohio*, 564.
 JOHN H. KNIESLY, *Horatio, Ohio*, 566, 567.
 HOMER M. KNOWLES, *Milnersville, Ohio*, 567.
 O. P. M. HUFFMAN, *Houston, Ohio*, 565.
 ED. RYNEARSON, *Gettysburg, Ohio*, 557, 564, 565, 566, 567, 568.
 CHAS. MANN, " " 566.

QUERIES.

603. Who was Wouter Van Twiller, and what noticeable features did he possess? GEO. L. SHANER.

604. What is the Golden Rule of the Arithmetic?

M. A. BROWN.

605. Where was Washington when he assembled his officers and bade his officers a final adieu? Id.

606. How many maxims did Washington write for his own use? Give them. How old was he then? What were his last words? Id.

607. Give the author of the following: D. W. K.

With devotion's visage,
And pious action, we do sugar o'er,
The Devil himself.

608. Has Alaska a territorial government? Id.

609. Why red and white stripes on the U. S. flag? What do these colors signify? Id.

610. What city deserves to be called the Lyons of America, and why? A. G.

611. Can problems, giving rise to affected quadratic equations, be solved by Arithmetical Analysis? Id.

612. Referring to 365 and 439. 1. Name and locate the gland that secretes "this air." 2. How do those fishes whose air-bladders are divided by partitions rise in water? 3. How do those fishes rise, whose air-bladder is closed? 4. Would not secretion so rapid as to be able to account for the sudden rise of a fish, be anomalous in physiology? 5. Is there not a better explanation of the functions of the swim-bladder than that which requires the "expelling" of the air?

E. S. LEWIS.

613. What and where are the following: Jemen, Paumotu, Pico dos Oragos, Roggeveld, Sumbing and Tanguban? ED. RYNEARSON.

614. What officer lost his life because he neglected to open a note?

Id.

615. Who first noticed the Gulf Stream?

Id.

616. What minister, who was chaplain of a New Jersey regiment during the Revolution, when the wadding of his regiment gave out, mounted his horse, rode to a church near by, and returned with an armful of Dr. Watts' hymn-books, which he distributed among the troops, with the pious injunction, "Now put Watts into them, boys!"? Give incident.

JOHN H. KNIESLY.

617. Who was Louis Kossuth, and for what purpose did he visit America? Id.

618. What gun was called the "Peacemaker," and what two noted men were killed by its explosion? Id.

619. Give a sketch of Louise Michel, and tell where she is now.

L. B.

NOTE.—Answers should reach us by May 5.



EDITED BY

JOHN S. ROYER.

VOL. VI.

MAY, 1885.

No. 5.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

704. By B. F. FINKEL, *Commercial Point, O.* A man digging a well 3 feet in diameter came to a log 3 feet in diameter, lying across the entire well; find solidity of part the log removed.

By A. F. PARSONS, *Arroyo Grande, Cal.*

Divide the solidity required into 4 equal parts by planes through intersections of cylinders. Let one part be cut by a plane parallel to intersection of the two planes and forming angle of 45° with them. This will form a rectangle. Put x = distance of this plane from center, then the sides of rectangle will be $2x$ and $2\sqrt{(r^2 - x^2)}$, and the solidity will be

$$4 \int_0^r x \sqrt{(r^2 - x^2)} dx = \frac{16r^3}{3}.$$

By A. L. FOOTÉ, *Hempstead, Long Island.*

The solidity of the log inside the well forms two groins with rectangular bases 3 ft. by 3 ft. and height $1\frac{1}{2}$ ft. Then $\frac{2}{3} \times 1\frac{1}{2} \times 3 \times 3 = 9$ cu. ft. in one of the groins and $2 \times 9 = 18$ cu. ft. in log inside of well.

W. L. Harvey, J. M. Greenwood, J. C. Gregg and J. R. Baldwin used the Calculus in its solution. Solved also by J. C. Corbin, A. M. Scripture and S. P. Bartlett.

705. By GEO. L. SHANER, *Stewarts Station, Pa.* A garden in the form of a rectangle, 128 by 112 feet, has a walk around it within the border, 4 feet in width, and two walks each 3 feet wide crossing each other in the center and extending to outer walk; what is the area of the garden not occupied by walks?

By L. A. REED, *Cleveland, Ohio.*

Area of garden, including walks, is $128 \times 112 = 14336$ sq. ft.; area of walks at the sides = $128 \times 4 \times 2 = 1024$ sq. ft.; area of walks at the

ends $= 104 \times 4 \times 2 = 832$ sq. ft.: area of cross walk from end to end $= 120 \times 3 = 360$ sq. ft.: area of cross walk from sides to middle walk $= 101 \times 3 = 303$ sq. ft.: total area of walks $= 1024 + 832 + 360 + 303 = 2519$ sq. ft., and the area not occupied by walks $= 14336 - 2519 = 11817$ sq. ft.

By D. S. POND, Rochester, Ohio.

Two walks each 4 feet wide and one 3 feet wide = 11 feet: $128 \times 11 = 1408$ sq. ft., three walks the length of the garden: $112 - 11 = 101$: $101 \times 11 = 1111$ sq. ft.: $1408 + 1111 = 2519$ sq. ft. of walk. Hence, $128 \times 112 - 2519 = 11,817$, sq. ft., answer.

Messrs. Schmitt, Ryneearson, McKibben, Dabe, Shaner, Wood, Jones, Wiley, Baldwin, Leisy, Smith, Parsons, Symmes, Anderson, Corbin, Scripture, Hieronimus, Harvey and Martin also solved it.

706. *By H. A. WOOD, New York.*—If A tells the truth 3 times out of 4; B, 4 times out of 5; and C, 5 times out of 6; what is the probability of an event that A and B assert and C denies?

By J. M. GREENWOOD, Kansas City, Mo.

The event did or did not occur.

1. The probability that A and B told the truth and that C falsified is $\frac{3}{4} \times \frac{4}{5} \times \frac{1}{6} = \frac{1}{10} \dots (1)$.

2. The probability that C told the truth and that A and B falsified is $\frac{5}{6} \times \frac{1}{4} \times \frac{1}{5} = \frac{1}{24} \dots (2)$.

3. The probability in favor of the first hypothesis is $\frac{1}{10} \div (\frac{1}{10} + \frac{1}{24}) = \frac{1}{17}$; and the probability in favor of the second hypothesis is

$$\frac{1}{24} \div (\frac{1}{10} + \frac{1}{24}) = \frac{5}{17}.$$

4. And $\frac{1}{17} + \frac{5}{17} = 1$, that is, the event did, or did not occur.

Solved differently by J. C. Corbin, J. C. Gregg and A. F. Parsons.

By the PROPOSER.

Let p = probability in favor of the event and q = probability against it. Since the event did or did not happen $p + q = 1 \dots (1)$. The probability of the event on the assertion of A and B and denial of C is $\frac{3}{4} \times \frac{4}{5} \times (1 - \frac{5}{6}) = \frac{1}{10}$, and the probability against the event is

$$(1 - \frac{3}{4})(1 - \frac{4}{5}) \times \frac{5}{6} = \frac{1}{4}.$$

Hence $p : q :: \frac{1}{10} : \frac{1}{4}$, then $10p = 24q$, or $5p = 12q \dots (2)$. From (1) $q = 1 - p$, which in (2) gives $10p = 24 - 24p$, whence $34p = 24$, and $p = \frac{12}{17}$, the probability required.

L. A. Reed, J. W. Jones, H. Gunder, Geo. C. Russell, A. M. Scripture, T. L. Brewer, Ed. Ryneearson and D. W. K. Martin solved it thus.

707. *By the same.*—If a ball is let fall from a height of 400 feet, and at the end of 3 seconds another is fired upwards with a velocity of 100 feet per second; where will the balls meet?

By A. L. FOOTE, Hempstead, Long Island.

In 3 seconds the falling ball will descend $s = \frac{1}{2}gt^2 = 16\frac{1}{2} \times 3^2 = 144\frac{3}{4}$ ft., and its velocity will be $v = gt = 32\frac{1}{6} \times 3 = 96\frac{1}{2}$ ft. The distance from position of descending ball at end of 3 seconds to the ground is $400 - 144\frac{3}{4} = 255\frac{1}{4} = a$ and put x distance falling ball descends till it meets the ascending one, and $a - x$ that of the ascending one. Then we have $x = tu + \frac{1}{2}gt^2$ u being the velocity at end of 3d second or

$$x = 96\frac{1}{2}t + 16\frac{1}{2}t^2 \dots (1),$$

and for the ascending ball $a - x = 100t - 16\frac{1}{2}t^2 \dots (2)$. Equating x in these we have $t = 2a \div 393 = \frac{1022\frac{1}{2}}{393} = 1\frac{235}{393}$ sec. Then for the point of meeting $s = tu - \frac{1}{2}gt^2$ or $\frac{1022\frac{1}{2}}{393} \times 100 - (\frac{1022\frac{1}{2}}{393})^2 \times 16\frac{1}{2} = 102\frac{209029}{74376}$ feet from the ground.

By H. GUNDER, New Castle, Ind.

Let the distance the first ball falls be y , and the second rises x . Then $y + x = 400 \dots (1)$. But $y = \frac{1}{2}g(t+3)^2 \dots (2)$, and $x = 100t - \frac{1}{2}gt^2 \dots (3)$ where t is the time of flight of second ball. Adding (2) and (3) $x + y = 400 = 100t - \frac{1}{2}gt^2 + \frac{1}{2}g(t+3)^2 \dots (4)$. From (4) $t = (400 - 4\frac{1}{2}g) \div (100 + 3g) \dots (5)$. Putting this value of t in (2) we get

$$y = \frac{1}{2}g \left\{ \frac{700 \div 4\frac{1}{2}g}{100 + 3g} \right\}^2 = 297.3192 \text{ ft.}, \text{ and } x = 102.6808 \text{ ft.}$$

Solved by Messrs. Parsons, Wiley, Scripture, Corbin, Pfeiffer, Martin, Gregg, Baldwin, Smith, Anderson, Harvey and the Proposer.

708. *By the same.* A circular field is inclosed by a fence with rails 15 ft. long and 6 rails high. If there are 24 times as many rails in the fence as acres in the field, how many acres does it contain?

By D. W. K. MARTIN, Webster, Ohio.

15 ft. $= \frac{1}{11}$ of a rod. Joining the center of the field with the ends of a panel in the circumference we have a sector whose arc is $\frac{1}{11}$ of a rod; and whose area is $\frac{1}{24}$ as many acres as there are rails in the arc or $\frac{1}{4}$ of an acre, and $(\frac{1}{4} \text{ of } 160) \div (\frac{1}{11} \div 2) = 88$ rods, radius of field. $\therefore 88^2 \pi \div 160 = 152.053$ acres.

By LEWIS McKIBBEN, Springfield, Ohio.

Let R be the radius in rods of the circular field; its area in acres will be $\frac{1}{160} R^2 \pi$ and its circumference will be $2R\pi$ and by the problem we have $2R\pi \times 16\frac{1}{2} \times 6 \div 15 = 24\pi R^2 \div 160$; divide by πR and reduce, we have $R = 88$ rods. $88^2 \pi \div 160 = 152.05344$ acres.

Geo. C. Russell, G. W. Sublette, A. F. Parsons, A. L. Foote, J. W. Pfeiffer, Wm. Wiley, J. R. Baldwin, W. B. Anderson, J. C. Corbin, A. M. Scripture, C. W. Hieronimus, D. S. Pond, J. C. Gregg and the Proposer also solved it.

709. By N. R. OLIVER, *Dorchester, Ont.* Given $x^2y+y^3x=304392$ and $x^2y-y^2x=6600$, to find x and y by a simple equation and without substitution.

By PROF. H. A. WOOD, *204 East 51st Street, New York.*

The second equation may be written $xy(x-y)=6600$, the first member being the product of the numbers multiplied by their difference. The factors of 6600 are 2, 2, 2, 3, 5, 5, 11. Dividing these factors into three groups so that the difference of the products of two groups may equal the product of the third group, we readily find

$$11 \times 3 - 2 \times 2 \times 2 = 5 \times 5.$$

Since x is the greater quantity, this gives $x=33$ and $y=5$, which satisfies also the first equation and hence are the values sought.

By COOPER D. SCHMITT, *Charlottesville, Va.*

We have $x^2y+y^3x=304392$. . . (1) and $x^2y-xy^2=6600$. . . (2). Let $xy=z$ and in (1) we have $z(x^2+y^2)=304392$. . . (3) and in (2) $z(x-y)=6600$. . . (4). Squaring (4) and subtracting from (3),

$$z^3-152196z=-21780000.$$

To solve this cubic, multiply both sides by z , then add to both sides $(264z)^2$ and we have $z^4-82500z=(264z)^2-21780000z$. Now add to both sides $(41250)^2$ and taking the square root, we obtain

$$z^2-41250=\pm(264z-41250),$$

which gives 264 for one value of z . Hence $xy=264$. This value of xy substituted in (2) gives $x-y=25$, whence we easily find $x=33$ and $y=8$. By using the other values of the cubic other results for x and y can be obtained.

By A. L. FOOTE, *Hempstead, N. Y.*

$x^2y+y^3x=304392$. . . (1), $x^2y-y^2x=6600$. . . (2). Factoring (1) and (2) gives $xy(x^2+y^2)=304392$. . . (3), $xy(x-y)=6600$. . . (4). Resolving (3) and (4) into proportions

$$xy : 304392 :: 1 : x^2+y^2 \dots (5), \quad xy : 6600 :: 1 : x-y \dots (6).$$

Combining (5) and (6), $304392 : x^2+y^2 :: 6600 : x-y$. . . (7). From which $(x^2+y^2) \div (x-y) = 1\frac{1}{2} \frac{3}{5}$. . . (8), or $x^2+y^2=1153$. . . (9) and $x-y=25$. . . (10). Squaring (10) $x^2-2xy+y^2=625$. . . (11). Subtracting (11) from (9), $2xy=528$. . . (12). Add (12) to (9), $x^2+2xy+y^2=1681$. . . (13). Extracting square root of (13),

$$x+y=41 \dots (14); \quad x-y=25, \text{ from which } x=33, \text{ and } y=8.$$

Solved by A. F. Parsons and J. C. Corbin.

Prob. 710 seems too ambiguous for successful solution. Perhaps there is a misprint. Will the proposer inform us?

711. *By* ED. RYNEARSON, *Gettysburg, Ohio*.—A general drew up his brigade in the form of a square and had one man left over; but receiving a re-enforcement of 423 men, he was able to increase the side of the square by 4 men; how many men had he at first?

By A. M. SCRIPTURE, *Clinton, N. Y.*

Extending the rank and file each 4 there would be a corner requiring 16 men to complete the square; $424 - 16 = 408$ added in rank and file exclusive of the corner. Half these were added to each of 2 sides $= 408 \div 2 = 204$, and as there were four rows there must have been $204 \div 4 = 51$ in each rank and file before the re-enforcement and $51 + 4 = 55$ after. $51 \times 51 + 1 = 2602 = \text{No. at first}$.

W. B. ANDERSON, *La Belle, Mo.*

Let $x = \text{No. on a side}$. Then $x^2 + 1 = \text{No. of men}$. $x + 4 = \text{No. on a side in the 2d square}$. Then $(x + 4)^2 = \text{No. in 2d square}$. $\therefore x^2 + 1 = (x + 4)^2 - 423$; whence $x^2 + 1 = x^2 + 8x + 16 - 423$; $8x = 408$ and $x = 51$. Hence $x^2 + 1 = 51^2 + 1 = 2601 + 1 = 2602 = \text{No. men}$.

Solved by B. F. Finkel, C. W. Hieronimus, D. W. K. Martin, J. C. Gregg, Ed. Rynearson, A. L. Foote, J. C. Corbin, Chas. M. Smith, J. R. Baldwin, Geo. H. Thomas, Wm. Wiley, H. A. Wood, S. P. Bartlett, J. W. Pfeiffer, L. A. Reed, Cooper D. Schmitt, G. W. Sublette, Geo. C. Russell, A. F. Parsons, J. E. Dabe and Lewis McKibben.

712. *By Request*.—Two cog wheels, one having 42 cogs and the other 30 cogs, run together; in how many revolutions of the smaller wheel will it gain 16 revolutions?

S. G. CAGWIN, *New London, N. Y.*

The L. C. M. of 42 and 30 is 210, which is the least number of cogs brought in contact till the wheels attain their original position. The larger wheel made $210 \div 42 = 5$ revolutions and the smaller $210 \div 30 = 7$. Hence by proportion, $(7 - 5) : 7 :: 16 : (56 \text{ revolutions})$.

By JOHN C. GREGG, A. M., *Brazil, Ind.*

While the small wheel makes one revolution the large wheel makes $\frac{5}{7}$ of a revolution; hence the small wheel gains $\frac{2}{7}$, and $16 \div \frac{2}{7} = 56$, the number of revolutions required.

Messrs. Foote, McKibben, Brewer, Sublette, Schmitt, Russell, Bartlett, Dabe, Pond, Thomas, Reed, Wood, Jones, Wiley, Baldwin, Symmes, Corbin, Leisy, Smith, Anderson, Scripture, Hieronimus, Martin and Rynearson solved it.

713. *By Request*.—The perimeter of a piece of land in the form of an equilateral triangle is 624 rods; find its area.

By J. W. JONES, *Circleville, Ohio*.

Each side $= 624 \div 3 = 208$; $\sqrt{(208^2 - 104^2)} = 180.1332$, altitude of triangle; $180.1332 \times 104 = 1873.38528$ area.

Messrs. Sublette, Harvill, Parsons, Schmitt, Russell, Foote, McKibben, Dabe, Brewer, Harvey, Gregg, Pond, Martin, Kniesly, Anderson, Smith, Leisy, Baldwin, Wiley, Pfeiffer, Wood, Rynearson, Bartlett, Thomas, Reed, Corbin and Scripture also solved it.

714. *By Request.*—I have a squared log twice as long as wide or deep, and make a trough out of it, leaving 2 inches at sides, ends and bottom: the solidity of the wood left in trough is 2216 cu. in. How many gallons does the trough hold?

By JOHN KNIESLY, ED. RYNEARSON, B. F. FINKEL *and* J. C. GREGG.

Conceive the trough cut crosswise into two equal parts, then each part is a cube similar to a box with the end and top pieces within the sides and bottom taken out, and a strip of 2 in. square across the edge at the intersection of these two square pieces. The solidity of this half trough is 1108 cu. in., and is made up of the following pieces: 4 square pieces like the 2 above-mentioned, 11 strips like the 2-in. strip, and 8 cubes containing $(2^3 \times 8) = 64$ cu. in. $\therefore$ the 4 square pieces and 11 strips have $1108 - 64 = 1044$ cu. in., and if laid side by side would cover $1044 \div 2 = 522$ sq. in. Now $\frac{1}{4}$ of (4 squares plus 11 strips), or 1 square + $\frac{11}{4}$ strips, must cover $522 \div 4 = 130\frac{1}{2}$ sq. in.: $\frac{11}{4}$ of a strip 2 in. wide is the same as 1 strip $5\frac{1}{2}$ in. wide; if we now split this strip lengthwise through the middle, we get two strips each $2\frac{3}{4}$ in. wide, and by placing these on two sides of the square piece we get a larger square lacking a corner of $2\frac{3}{4} \times 2\frac{3}{4} = 7\frac{9}{16}$ sq. in.: the side of this larger square is $\sqrt{(130\frac{1}{2} + 7\frac{9}{16})} = 11\frac{3}{4}$ in.: subtracting $2\frac{3}{4}$ in. from $11\frac{3}{4}$ in. leaves 9 in. for the side of one of these four square pieces, which is the width of the trough, and the log was $9 + 4 = 13$ in. square and 26 in. long, hence the capacity of the trough is

$$[(13^2 \times 26) - 2216] \div 231 = 9\frac{3}{7} \text{ gal.}$$

NOTE.—To illustrate, cut from an inch board 8 cubes, 11 square prisms 3 inches long, and 4 squares 3 inches each way. Lay down one of the squares on a flat surface, around it arrange four prisms and four cubes; on top of these set up three squares on edge, four prisms on ends; on top place three prisms lengthwise and four cubes, and you have a representation of half the trough, top and one end open.

By J. W. PFEIFFER, *Bolivar, Ohio.*

Let x = width or depth and $2x$ = length: also $2x - 4$, $x - 4$ and $x - 2$ = length, width and depth inside of trough. Hence

$$2x^3 - (2x^3 - 16x^2 + 40x - 32) = 2216.$$

Reducing, $16x^2 - 4x = 2184$, from which $x = 13$ and $2x = 26$. Hence,

$$(22 \times 9 \times 11) \div 231 = 9\frac{3}{7} \text{ gal.}$$

Solved thus by Messrs. Pond, Parsons, Schmitt, Russell, Foote, Wood, Reed, Baldwin, Leisy, Smith, Anderson, Corbin, Martin and Harvey.

644. How much tin, allowing 10% for lap, will it take to roof a dome whose height is 4 ft., and whose base is an octagon, and the ridge of the roof from each angle to the diametrically opposite angle is a semi-circle?

By A. F. PARSONS, *Arroyo Grande, Cal.*

The published solution seems erroneous, from the fact that the surface of the dome is made to consist of triangles, which reduce the dome to a pyramid.

Conceive the dome inscribed in a hemisphere. The ridges of the dome will lie in the surface of the hemisphere and will divide it into eight equal parts. The hemisphere may be considered as composed of an infinite number of circular planes (radii varying from r to 0) parallel to the base. The surface of the hemisphere then is composed of the circumferences, and that portion between adjacent ridges of the arcs of 45° in these circles. Hence, the surface of $\frac{1}{8}$ of the dome will consist of the chords of 45° in the same circles. That is, the surface of hemisphere : surface of dome :: arc of 45° : chord $45^\circ = \frac{1}{8}\pi : \sin 22\frac{1}{2}^\circ$. Surface of dome = $16r^2 \sin 22\frac{1}{2}^\circ = 97.966848$ sq. ft. ($r=4$). The amount of tin = $97.966848 \div .90 = 108.85205$ sq. ft.

Problems for Solution.

738. By W. B. ANDERSON, Pres. Western Academy, *La Belle, Mo.* A man bought a farm for \$6000, and agreed to pay principal and interest in three equal annual installments. What was the annual payment, interest being 6%?

739. By ED. RYNEARSON, *Gettysburg, Ohio.*—A speculator invests \$2120 in grain, including 4% for freight and 20% for commission; then sells the grain at 20% advance on the cost price for a note at 60 days, which he gets discounted at bank at 6%, and repeats this operation every 10 days; how much will his gains amount to in a month, if he invests the whole proceeds each time?

740. By A. F. PARSONS, *Arroyo Grande, Cal.*—A square field has a road $82\frac{1}{2}$ feet wide running through it. The road enters the field 10 rods from one (N. E.) corner and leaves it 15 rods from the S. W. corner on the opposite side. The area of the field exclusive of road is 40 acres. Required the side of field.

741. By ROBT. J. TOTTEN, *New Wilmington, Pa.*—Find the circumference of a circle in which a regular decagon, side 10 inches, may be (1) inscribed, (2) circumscribed.

742. By HON. JOSIAH H. DRUMMOND, *Portland, Me.*—In a right-angled triangle whose base is 1 and whose perpendicular is $\frac{3}{4}$, inscribe a square one side of which lies upon the base, and one on the perpendicular; then in the remaining triangle, inscribe a square one side of which lies on the base, and so on *ad infinitum*. Required the total area of the series of inscribed squares.

743. By W. L. HARVEY, *Margfield, Me.*—Charles Garland carried to market a hog weighing 200 lbs., also one for John Day weighing 300 lbs., and sold the two hogs for \$30. The butcher decided that John Day's hog was worth 1 cent per lb. more than Charles Garland's. How much should each receive for his hog?

744. By G. H. HARVILL, *Ada, La.*—There are p arithmetical progressions beginning with 1, and the common differences are 1, 2, 3, etc., to p ; prove that the sum of their n th terms = $\frac{1}{2}[(n-1)p^2 + (n-1)p]$.

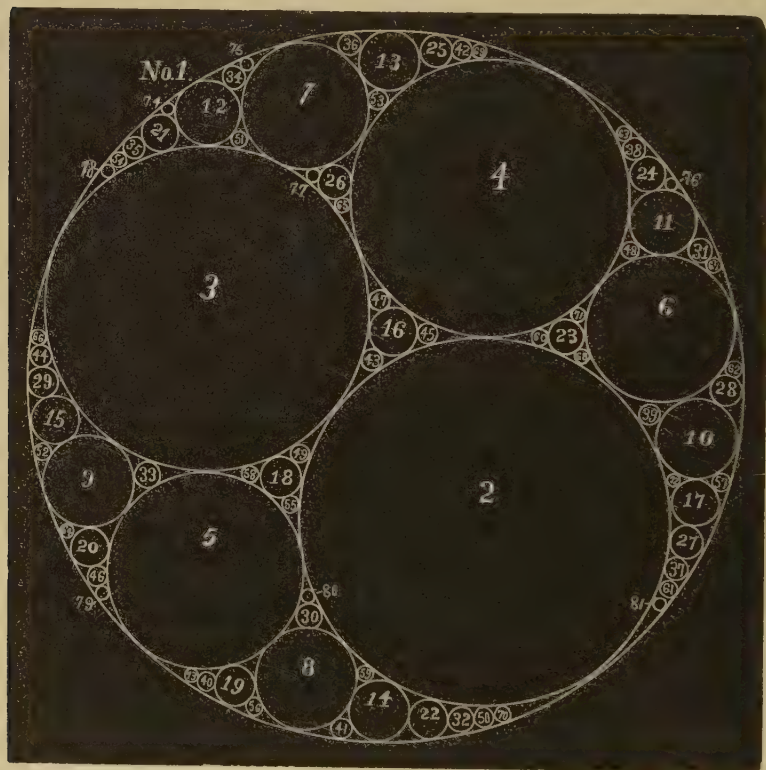
Solutions should be received on or before June 15.

A PROBLEM AND ITS SOLUTION.

BY D. H. DAVISON,

Surveyor and Civil Engineer, Minonk, Ill.

Given radii of any three circles that are mutually tangent to each other to find two other circles each of which is tangent to the 3 given circles. Also determine as many tangent circles as may be required. For instance we have given circles Nos. 1, 2, and 3, in the diagram having radii respectively 168, 88, and 3, to determine all inscribed circles which are as large as the smallest given circle.



Reduce the three given circles to equivalent fractions having a common numerator N . Let a, b, c , represent the three consecutive denominators, and the three given radii become

$$\frac{N}{a}, \frac{N}{b}, \frac{N}{c}$$

In *School Visitor*, Vol. II., p. 117, we have "Given radii a, b, c , of

three mutually tangent circles to find r , the circumscribing circle." A general solution of this interesting proposition by that most profound and matchless mathematician, the late lamented Prof. E. B. Seitz,

gives $r = \frac{abc}{2\sqrt{[abc(a+b+c)] - (ab+ac+bc)}} \dots (1)$. Introduce $\frac{N}{a}, \frac{N}{b}, \frac{N}{c}$, instead of a, b, c , in (1) and when reduced to its simplest form,

$$r \text{ or } r' = \frac{N}{2\sqrt{(ab+bc+ac) \mp (a+b+c)}} \dots (2).$$

When any three mutually tangent circles are given, this formula will find two other circles each tangent to the three given circles. If circles 2, 3, 4, are given the minus result gives the circumscribing circle No. 1, and the plus result gives No. 16. If circles 2, 3, 18, are given the minus result gives 5, and plus result gives 49. When the circumscribing circle is taken as one of the three given circles it must be considered minus. Hence in the given example we have -168, 88 and 3. These numbers reduced to equivalent fractions having a common numerator are $-\frac{1848}{11}, \frac{1344}{21}, \frac{1848}{16}$; hence $a = -11, b = 21, c = 16$. It is remarkable that any three circles that are mutually tangent to each other in any proposition, when reduced to equivalent fractions having a common numerator, will produce the same common numerator as any other three tangent circles; hence $N = 1848$ is constant and it only becomes necessary to find the denominators of the required circles. Introducing these values of N, a, b, c , into (2) gives $r = 3\frac{5}{9}$ being No. 61, and $2\frac{2}{5}$, being a smaller circle on opposite side of No. 81, being also tangent to the three given circles.

Although (2) will determine all required circles in any given proposition, yet it is not necessary to use it but once in any similar example, for all other circles can be determined much more rapidly from Series by Successive Induction. A series consists of a chain or connecting line of circles, each of which is tangent to the next preceding circle, and the next following circle. All circles in a series are tangent to the two circles between which the series terminate. The terminating point of the series is at the tangent point of the two circles, to which all circles in the series are tangent. The series may be considered to surround the smaller of these tangent circles. The number of circles in a series is infinite! There is also no limit to the number of series, for each circle in a series may have three distinct series around it. Each of these series may be considered to terminate at the points of tangency with the three other circles that are mutually tan-

gent to it. For instance the three circles that are mutually tangent to No. 5 are 1, 2 and 3. The series terminating at tangency of 5 with 1, is 73, 40, 19, 8, 2, 3, 9, 20, 46, 79, etc. The series terminating at tangency of 5 with 2, is 55, 18, 3, 1, 8, 30, 80, etc. The series terminating at tangency of 5 with 3, is 58, 18, 2, 1, 9, 33, etc.

In addition to the three continuous series mentioned around each circle, there are other series as follows: 28, 11, 7, 9, 19, etc., may be considered an exterior detached series, and 23, 16, 18, 30, etc., an interior detached series around 2; circles 71, 47, 58, form part of a sub-detached series, etc.

All series are governed by the same law of succession, and when any three consecutive circles in a series are known all other circles in the series can readily be determined as follows:

Reduce the three given circles to equivalent fractions having a common numerator N . Let a, b, c , = 1st, 2d and 3d denominators; let d = difference = $b - a$; $d' = c - b$; m , common measure of difference = $d' - d$: being constant for any given series; n = number of any required circle in a series from the initial circle; D = denominator of any required circle in a series. The differences between the several consecutive denominators of a series are in arithmetical progression. Hence commencing with the initial circle, which may be taken in any part of the series, the several consecutive denominators may be represented as follows:

$$a, a+d, a+2d+m, a+3d+3m, a+4d+6m, a+5d+10m, \dots$$

Summing the increment m to the n th circle in the series and restoring its value in terms of n we have the General Formula

$$D = a + (n-1)[\frac{1}{2}m(n-2) + d] \dots (3)$$

which is true for any and all series not only for the given example but for any similar example that may be given. But when all circles in a series are required they can better be determined consecutively as follows: we have given the three consecutive circles $2\frac{2}{3}$, 3, and $3\frac{1}{3}$; reduced to equivalent fractions having a common numerator we obtain $a=780$, $b=616$, $c=472$; hence, $d=-164$, $d'=-144$. Therefore, $m=20$. The 4th denominator is found by increasing c by $d+m$, and each succeeding additive term is found by simply adding m to the preceding additive term; hence, $472, -124=348, -104=244, -84=160, -64=96, -44=52, -24=28, -4=24, +16=40, +36=76, +56=132, +76=208, +96=304, +116=420, +136=556$; prefixing the general numerator $N=1848$ and reducing to simplest form,

we find circles in series around No. 2 within the required limits from Nos. 81 to 70 are $3, 3\frac{5}{9}, 5\frac{9}{9}, 7\frac{3}{1}, 11\frac{1}{2}, 19\frac{1}{4}, 35\frac{7}{3}, 66, 77, 46\frac{1}{5}, 24\frac{6}{9}, 14, 8\frac{2}{3}, 6\frac{2}{3}, 4\frac{2}{3}, 3\frac{4}{5}$.

If we wish to find the 102d circle in the series (3) gives

$$D=780+101(10+100-164)=\frac{1848}{85216}=\frac{231}{10652}.$$

We now have circles 4, 1, and 5, respectively 66, -168, and $46\frac{1}{5}$, from which $a=28, b=-11, c=40$; $\therefore d=-39, d'=51$, and $m=90$; $\therefore 40, +141=181, +231=412$, reduced to simplest form give No. 18= $10\frac{38}{181}$ and No. 49= $4\frac{50}{103}$. Now in order to reverse the work and find the other terminus of the series we increase a by d with its sign changed plus m ; $\therefore 28, +129=157, +219=376$, from which No. 16= $11\frac{21}{157}$ and No. 43= $4\frac{2}{17}$. Now having 1, 2, 16, find $47=4\frac{269}{97}$ and reverse find $7=30\frac{18}{61}, 26=7\frac{63}{7}, 65=3\frac{27}{47}$. From 4, 2, 5, find 9, 15, 29, 44, 66, and 7, 12, 21, 35, 54, 78. From 3, 2, 6, find 11, 24, 38, 63, and 7, 13, 25, 42, 69. From 14, 2, 5, find 19, 56, and 41. From 2, 3, 9, find 20, 46, 79, and 8, 19, 40, 73. From 2, 4, 11, find 31, 67, and 10, 28, 62. From 3, 1, 8, find 30, 80, and 18, 55. From 26, 16, 18, find 33, and 51. From 28, 11, 13, find 34, 74, and 57. From 10, 5, 12, find 36, and 31, 76. From 18, 16, 23, find 39, 72, and 30, 59. From 3, 1, 6, find 23, 60, and 16, 45. From 2, 1, 11, find 48, and 23, 71. From 5, 3, 15, find 52, and 20, 64. From 23, 16, 26, find 53. From 55, 2, 3, find 58. From 60, 4, 6, find 68. From 3, 12, 34, find 75. From 1, 4, 26, find 77.

The circles arranged in the order of their size are 168, 88, 77, 66, $46\frac{1}{5}, 35\frac{7}{13}, 30\frac{18}{61}, 24\frac{6}{9}, 21\frac{63}{5}, 19\frac{1}{4}, 15\frac{31}{9}, 15\frac{3}{5}, 14, 14, 11\frac{11}{13}, 11\frac{21}{57}, 11\frac{11}{20}, 10\frac{38}{131}, 9\frac{7}{17}, 9\frac{3}{205}, 8\frac{23}{6}, 8\frac{18}{71}, 8\frac{5}{9}, 7\frac{63}{7}, 7\frac{63}{79}, 7\frac{35}{61}, 7\frac{7}{23}, 7\frac{7}{23}, 6\frac{46}{55}, 6\frac{5}{13}, 6\frac{3}{38}, 5\frac{101}{103}, 5\frac{67}{79}, 5\frac{67}{79}, 5\frac{1}{2}, 5\frac{9}{29}, 5\frac{103}{349}, 5\frac{103}{349}, 5\frac{1}{25}, 4\frac{356}{73}, 4\frac{43}{47}, 4\frac{43}{47}, 4\frac{43}{47}, 4\frac{74}{97}, 4\frac{108}{127}, 4\frac{360}{97}, 4\frac{76}{135}, 4\frac{50}{103}, 4\frac{2}{5}, 4\frac{64}{21}, 4\frac{26}{109}, 4\frac{152}{151}, 4\frac{152}{151}, 4\frac{111}{115}, 3\frac{111}{117}, 3\frac{23}{67}, 3\frac{63}{67}, 3\frac{63}{67}, 3\frac{54}{59}, 3\frac{54}{59}, 3\frac{41}{41}, 3\frac{25}{43}, 3\frac{25}{43}, 3\frac{27}{47}, 3\frac{13}{25}, 3\frac{225}{541}, 3\frac{27}{68}, 3\frac{67}{183}, 3\frac{45}{139}, 3\frac{153}{565}, 3\frac{153}{565}, 3\frac{81}{589}, 3\frac{81}{589}, 3\frac{1}{51}, 3, 3, 3, 3, 3, 3, 3. Lines connecting the three equal circles 57, 58 and 59 form a right triangle. A line connecting the three equal circles 76, 77, 78, is parallel to a line connecting the remaining three equal circles 79, 80, 81, these two lines being parallel to, and equidistant from, a line passing through center of circle connecting the two equal circles 28 and 29; these three lines are bisected by a line through center of circle connecting the two equal circles 13 and 14.$

When the diameter of two of the inscribed circles is equal to diameter of the circumscribing circle as is the famous Archimedes-prob-

lem, and also Martin Rice's celebrated prize-problem, then the terms under the radical in formula (2) reduce to zero and the formula simply becomes $r = N \div (a+b+c)$; this finds the third inscribed circle in all similar examples.

When the dimensions of the three given circles are such that the exterior tangent line is a straight line, then the denominator of (2) reduces to zero, thus showing the tangent line is infinite! And we have

$$2\sqrt{ab+(b+a)c} = a+b+c, \text{ from which } c = a+b \mp 2\sqrt{ab} \dots (4).$$

When any two circles are given that are tangent to a straight line this formula finds two other circles each of which is tangent to the two given circles and to the straight line.

COPY RIGHT.

NOTE.—We believe that Mr. Davison's solution of the Circle-Problem contains a new discovery in mathematical science. He utilizes the formula given by that prince among mathematicians, our lamented friend, E. B. Seitz, and determines a simple, unique, and entirely original method by which he puts all circles, in any given example, from series by *Successive Induction*, very easily and rapidly indeed. He has put in more than seven hundred circles as shown in the foregoing solution, in as many minutes by series as would require hours by putting them in singly by the general formula.

Mr. Davison's attention was first called to this remarkable principle, by our esteemed contributor and friend, N. B. Oliver, M. D., of Dorchester, Ontario, who sent him Mr. Rice's celebrated prize-problem: viz., "Given two circles, radii 110 and 90, also 200 the circumscribing circle, to determine all interior circles." Mr. Rice claims that a similar problem was given by Archimedes more than 2000 years ago, and that no solution was ever produced. Mr. Davison's method will solve Mr. Rice's problem in a very simple form, and when Mr. Rice, of Lone Jack, Mo., received the correct computations of about sixty circles as made by Mr. Davison, he expressed himself "delighted, surprised and astonished" at the accuracy of the results, and spoke of our friend's discovery as the missing link which he has long tried to find. Mr. Rice, who publishes a book, awarded the prize to Mr. Davison for his successful work. As the readers of our magazine embrace some of the finest mathematicians and scholars of this country, we should be glad to receive opinions on the merits of the foregoing solution.

EDITOR.

This issue is mailed Thursday, May 14.

G. W. Sublette solved Probs. 705 and 706. His solutions came too late for proper insertion.

ERRATUM.—In the third line from the bottom of Prob. 710, the phrase "till their *dinners* should even be" ought to read "till their *dimes* should even be."

We shall try to get the June No. into the mails about the first of the month. This issue is delayed somewhat on account of securing the "copy right" of Mr. Davison's solution of "Circle-Problem."

E. P. Clemens has been elected Principal of the U. L. Institute, at Spartansburg, Ind., for the ensuing year. Friend Clemens renders good satisfaction at that place, and has taken the *Visitor* from its start.

During the summer vacation and at institutes, our readers can do a good thing for us and their friends by recommending the *School Visitor* to such as should have its aid. We always appreciate favors. Back Nos. can be supplied. We also furnish Eubank's Key to Harvey's Analysis. Price two dimes.

ENGLISH GRAMMAR.

Please diagram the 16th, 23d, 57th and 60th sentences under "Exercises" in Harvey's Revised Grammar, page 228. J. W. STAHL.

16. Whether is greater, the gold or the temple?

{ whether or is-greater	gold the	<i>Whether</i> is an antiquated pronoun, signifying <i>which one</i> of two.
	temple the	

23. All this, I heard as one half dead; but answer had I none to words so true, save tears for my sins.

{ I heard but I had answer	[] all	{ this one dead half [hears] as none to words true so save tears for sins my

57. For what is worth in any thing

But so much money as 't will bring? — *Butler*.

(for) { what but money is-worth in thing	much so	{ it will bring as any

60. I can not tell what you and other men

Think of this life; but for my single self,

I had as lief not be as live to be

In awe of such a thing as I myself. — *Shakespeare*.

{ I can tell but I thinking for self had be	not	{ the you and men other of life this think which my single

{ I would live	as	{ such a I myself am-as

Diagram — Do not let them know who the boys are.

P. C.

{ [you] do let	not	{ boys the are—who

Examination Questions.

NOTE.—Thirty-two were examined on this list, two of whom were ladies. Persons failing on such a list must be very deficient in the principles of the several branches. It is not likely that one can teach properly what he does not understand himself.

ARITHMETIC.

1. The sum of $1\frac{1}{2\frac{1}{5}}$ and $1\div 1\frac{4}{9}$ is equal to how many times their difference?
Ans., 5 times.
2. Find the cost of a board 20 ft. long and 9 in. wide at \$15 a thousand.
Ans., $22\frac{1}{2}$ cts.
3. A circular park is 165 yards in diameter; how many acres does it contain?
Ans., 4.417875.
4. Divide 1065 in proportion to 3, 5 and 7; also in proportion to $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{7}$.
Ans., 213, 355, 497; 525, 315, 225.
5. If I start at a certain point and travel 90 miles due north and then 50 miles due west, how far will I be from the starting point? *Ans.*, 103—mi.
6. A vessel containing 30 gal. of beer would contain how many gallons of wine?
Ans., $36\frac{2}{7}$ gals.
7. If $12\frac{1}{2}\%$ of what I receive for an article is gain, what is my rate of gain?
Ans., $14\frac{2}{3}\%$.
8. The boundaries of a square and circle are each 30 ft.; which contains the most and how much? *Ans.*, circle, 15.3654 sq. ft.
9. Find the amount of a note of \$3500 payable in four years from date, with interest at 6%, payable annually, if no interest had been paid?
Ans., \$4415.60.
10. What is the solidity of a cylinder whose altitude is $10\frac{1}{2}$ in. and the diameter of whose base is 5 in.? *Ans.*, 206.1676 cu. in.

NOTE.—We are indebted to Ed. Rynearson, a late pupil of ours, for these answers. He solved every problem correctly at the last examination. He received a certificate of a 3-years' grade.

GEOGRAPHY.

1. Define plateau, delta, estuary, ecliptic, climate.
2. What plateaus are separated by the Wahsatch Mts.
Ans.—Plateau of the Colorado and the Great Basin.
3. Name the states that border on the Gulf of Mexico, and give their capitals.
4. What three chains of islands constitute the West Indies?
Ans. Bahamas, Greater Antilles and Lesser Antilles; however, the latter may be considered as composed of two chains.
5. What countries of Europe border on the Mediterranean sea?
6. What countries are separated and what waters connected by the Strait of Dover?
7. What three peninsulas project from the Southern part of Asia?
8. What waters are connected and what lands are separated by the Strait of Babel-el-Mandeb?
9. In what zones does Australia lie? To what European power is it subject?
Ans.—S. Torrid and S. Temperate. It is subject to Great Britain.

10. What and where are the following: Khartum? Herat? Manitoba? Guatemala? Tonquin or Tong King?

Ans. *Khartum* is the headquarters of the Egyptian government in Nubia. *Herat* is one of the capitals of Afghanistan. *Manitoba* is a province of the Dominion of Canada. *Guatemala* is a republic of Central America. *Tonquin* is the most northern province of Cochin-China.

HISTORY.

1. How came the natives of America to be called Indians?

Ans.—The application of the name Indians to the native peoples and tribes of the New World is an erroneous usage, originating in the belief of the Spanish discoverers of America that they had reached the eastern shores of Asiatic countries already partially known.—*Britannica*.

2. What is the oldest college in our country? How did it get its name?

Ans.—Harvard. Named after John Harvard who left the college four hundred pounds and all his library.

3. What was the Stamp Act? When was it passed?

Ans.—It provided that legal documents, newspapers, and pamphlets required stamps, and that each advertisement should pay a duty of two shillings. It was passed by Parliament in February, 1765.

4. What were the Alien and Sedition Laws? In whose administration were they passed?

Ans. In July, 1798, in John Adams's administration the "Alien and Sedition" laws were passed by Congress; the former making it possible for the president to arrest any foreigner, and send him out of the country, and the latter subjecting to a heavy fine and imprisonment any one who might be found aiding or abetting any resistance to the U. S. government.

5. When and where was St. Clair's defeat?

Ans.—Nov. 4, 1791, near what is now Fort Recovery, Ohio.

6. Describe the battle of Lake Erie. Who was then president?

Ans.—Commodore Perry with nine vessels, met the British fleet on Lake Erie, Sept. 10, 1813, and gained a glorious victory. James Madison.

7. What caused the war between the U. S. and Mexico? In whose administration did it occur? Name five important battles in it.

Ans.—Annexation of Texas. James K. Polk's. Palo Alto, May 8, 1846; Bra-ceti, Dec. 25; Buena Vista, Feb. 23, 1847; siege of Vera Cruz, March 22-29; Cerro Gordo, April 18.

8. When did the Emancipation Proclamation go into effect?

Ans.—Jan. 1, 1863.

9. What events of great importance to the Union Cause occurred on the 3d and 4th of July, 1863?

Ans.—Battle of Gettysburg and capture of Vicksburg.

10. State briefly your method of teaching history.

GRAMMAR.

1. Define and give examples of *finite*, *defective*, *redundant* and *unipersonal* verbs.

Ans.—A *finite* verb is one limited in person and number by a subject. A *defective* verb is one which wants some of its principal parts. A *redundant* verb has more than one form for its past tense or perfect participle. *Unipersonal* verbs assert an act or state independently of any specific subject.

2. Give the principal parts of the verbs: *freight*, *swim*, *kneel*, *work* and *light*.

Ans.—Freight, freighted; swim, swam; kneel, knelt or kneeled; work, worked or wrought; light, lighted, lighted.

3. Re-write the following and make it correct in every particular: whatever happens exclaims mary i am the wife of the king of spain crown rank life all shall go before before i take any other husband

Ans.—“Whatever happens,” exclaims Mary, “I am the wife of the prince of Spain. Crown, rank, life, all shall go, before—before I take any other husband.”

4. What is a *figure of speech*?

Ans.—A departure from the ordinary form, regular construction, or literal meaning of words.

5. Give examples illustrating four different constructions of *that*.

Ans.—*That* (adj.) person is wrong. He said *that* (conj.) I was wrong. This is the dog *that* (pronoun) killed the rat. He told me how to parse *that* (noun).

6. Write a sentence illustrating the *Historic Present Tense*.

Ans.—The present tense is often used instead of the past, in order to give animation to description. The historian, the poet, and the orator use this form frequently, by which they can make the dead past become the living present. Examples:—He *walks* (for walked) up to him and *knocks* (for knocked) him down. Luke *gives* (for gave) a vivid description of Paul's travels.

7. Compare: far, ill, round, much, little.

Ans.—Far, farther, farthest; ill, worse, worst; round (not compared); little, less, least.

8. Write words with proper diacritical marks illustrating ten vowel sounds.

Ans.—See dictionary or spelling-book.

9. Parse—*Whatever* he does, you *mind what* I told you.

Ans.—*Whatever* is a compound relative pronoun, equivalent to *any thing which*. *Thing* is in the absolute case (used independently) and *which* is the object of *does*. *Mind* and *told* are transitive verbs, the former governing the antecedent part of *what* and the latter the relative part. *You* is the object of *to* understood.

10. Diagram:—There's not a beggar in the street
Makes such a sorry sight.

(there)	a	
{	beggar	on street the
		[]
	is not	makes sight such a sorry

SPELLING.

Erasable, collectible, gneissose, lyrist, armistice, pseudonym, diurnal, hibernial, incision, moneyless, penniless, roguish, macaroni, partial, hemorrhage, dialogue, dynamics, tocsin, drizzle, ophicleide.

We are requested by P. C. to diagram the following sentence from Harvey:

The garret was filled with broken chairs, cast-off garments, and what not.

{	garret	the	
			with chairs broken
			and
	was filled	[] garments cast-off	
		and	
		[] what not	

What not is a phrase, partaking of the nature of a noun, and is the object of *with* understood.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

573. Whittier's poem, *Massachusetts to Virginia*, was written on reading an account of the proceedings of the citizens of Norfolk, Va., in reference to George Latimer, the alleged fugitive slave, etc. Give said proceedings, and give, also, the incidents pertaining to the negro Somerset, of England, in 1772, mentioned in a foot-note to the same poem.

Id.

Ans.—[Jan. No. '85]. I have given much time to the investigation of this query, and finally found a very intelligent colored man, Jos. T. Wilson, author of an excellent book entitled, *Emancipation*, and editor of a weekly paper, *The Right Way*, who personally knew Geo. Latimer. Mr. Wilson says Latimer was bar tender for Robt. Rea, in Norfolk until he ran away, and when he reached Boston, was aided by abolitionists to escape from his pursuers, and reach a safe asylum in Canada. The date must have been about 1847, but I find no record of any public meeting or resolutions of the citizens of Norfolk relating to the case. Mr. Wilson, who is well informed, promises to find out what he can about the alleged resolutions or proceedings. Our "oldest inhabitants," lawyers, judges, etc., know nothing about it, and newspaper files have thus far failed me.

I can tell you of the Somerset case. In 1771, a Bostonian, Charles Stewart, took his negro slave James Somerset to England, and left him sick in London. When the master learned that his slave was well, and profitably employed, he had him arrested and put on the vessel *Ann and Mary* about to sail for Jamaica. Friends of Somerset had him taken before Lord Mansfield on a writ of *habeas corpus*, and the result was his discharge from custody, on the principle that "slaves cannot breath in England." Somerset's presence in England was of itself evidence of his freedom. The public interest in Lord Mansfield's righteous decision, led to the abolition of slavery in Massachusetts.

Richard Hildreth, the historian, says in *Despotism in America*, page 200, that James Somerset, an African by birth, carried to Virginia as a slave and purchased there by James Stewart, had been brought from Virginia to England, where he refused to serve any longer. A more careful compiler, Geo. W. Williams, the first colored Ohio legislator, in his great work on the "History of the Negro Race in America," says it was Charles Stewart, of Boston, Mass. Possibly the second volume of Williams' History, to which I have not access now, will give an account of Latimer.

N. B. WEBSTER, Norfolk, Va.

578. Who established the first orphan asylum in America?

Ans.—George Whitefield, the "golden-mouthed" preacher of the 18th century, established the first orphan asylum in America, near Savannah, Ga., about the year 1738. This institution is known in history as "Whitefield's Home of Mercy."

JOHN H. KNIESLY.

At first he hired a building, but afterwards moved into a house built for his purpose. In about a year he had sixty-eight orphans under the care of his institution.

ED. RYNEABSON.

579. What noted man of Ohio defeated his competitor for Congress by a single vote, and afterwards married his competitor's favorite daughter?

Id.

Ans.—William Allen.

PROPOSER.

580. What was the Koszta Affair? Give incident.

Ans.—Martin Koszta was a leader in the Hungarian revolt against Austria in 1849. After the rebellion was suppressed he fled to Turkey but was demanded

by the Austrian government as a refugee and traitor. The Turkish authorities refused to give him up, but agreed that he should be exiled to some foreign country never to return. Koszta chose the U. S. for his asylum, but returned to Turkey in 1854, contrary to his promise. At Smyrna the Austrian consul induced some bandits to seize him and throw him into the water, where he was picked up by a boat and carried on board an Austrian frigate. The American officials demanded his release, which was refused by the Austrians, but it was afterward agreed that Koszta should be put in charge of the French government until his nationality should be decided. The question was discussed by Baron Hulseman, the Austrian minister at Washington, and Wm. L. Marcy, the American Secretary of State. Mr. Marcy was completely triumphant in his argument and Koszta was remanded to the U. S. D. W. K. MARTIN.

† 581. Who was chaplain of the old Continental Congress, and where did that Congress meet? Id.

Ans.—The old Continental Congress met in Carpenters Hall, in Philadelphia on the 5th of September, 1774. It numbered fifty-five members, consisting of delegates from every colony save Georgia, whose governor had prevented the election of delegates. It was proposed to open the sessions with prayer, and upon the motion of Samuel Adams, the Rev. Mr. Duche, an Episcopal clergyman of Philadelphia, was invited to act as chaplain. Mr. Duche accepted the invitation.—McCabe's History of the U. S.

582 Give the legends about the robin. L. C. ROOT.

Ans.—There are three we know of: (1) That it is unlucky to kill a robin; (2) That the robin plucked a thorn from the temple of the Savior as he passed to Calvary, and a drop of blood dropped on its breast producing the redness thereof. (3) That in carrying the dews of morning to refresh the tormented sinners in hell, the scorching flames of that hot region turned his feathers red. Whittier alludes to this in the following quotation from his poem on the Robin:

He brings cool dew in his little bill,
And lets it fall on the souls of sin;
You can see the mark on his red breast still,
Of fires that scorch as he drops it in.

583. Why are counties in La. called parishes? Id.

Ans.—When the French first came to that part of the country, the precinct, the inhabitants of which belong to the same church, was called a parish and it has since retained this name. ED. RYNEARSON.

584. What is a bill of attainder? an *ex post facto* law?

Ans.—A *bill of attainder* is a bill rendering the person against whom it is passed, infamous, and is stained and disgraced. The person forfeits all his property, real and personal, to the government. By operation of law, his blood becomes so corrupted, that he can neither inherit anything from his ancestry, nor transmit hereditary descent to his heirs. Congress shall not pass such a law.

An *ex post facto* law renders an act criminal which was not so at its time of commission. The U. S. Supreme court defines it as a law which renders an act punishable in a manner in which it was not punishable when it was committed. J. WOMELSDORF.

(a) A Bill of Attainder is a bill in Parliament, introduced for enacting the attain and punishment of persons who have criminally offended against the state and public peace. (b) *Ex Post Facto*, a law which is put into operation by later enactments, the power to pass such not being held by U. S. or State governments. It applies only to penal and criminal statutes, and was introduced into the common law from the civil. *Vide People's Cyclopaedia*.

E. M. OWENS.

A species of extraordinary proceeding against parties accused of treason or felonies, which can not be reached by the ordinary course of justice. During the reign of the Tudors, the more constitutional process of impeachment was laid aside, and attainders were generally adopted in the case of state criminals. These bills usually originated in the house of Lords, they are now of very rare occurrence. *Ex post facto* literally means *by something done afterwards*. A punishment inflicted in consequence of a law, made with a view to a particular offence already committed is said to be inflicted *ex post facto*. And the phrase "Ex post facto law" is popularly applied to all laws enacted with a retrospective effect, and with intention to produce that effect, which are justly regarded as tyrannical. See *Brande's Cyclopaedia*. A. L. F.

585. Who was the "Swamp Angel" of the late civil war? Id.

Ans.—Gen. Gilmore was in command of the engineers at the siege of Charleston, in 1863. He sent Capt. Michel, now general at West Point, to see if there was any point on the coast where guns could be placed to attack Charleston. He reported that the coast was all swamp, three or four miles inland, with water and mud forty feet deep. Lieu. Harrold was next sent to reconnoitre, but he thought it impossible to mount guns there. Col. Serrel said it had to be done, and took Lieu. Edwards with him. By the use of a plank they worked their way through to a point within 5 miles of Charleston.

On their return it was decided to build a bridge to that point, and the soldiers carried planks and 10,000 bags of sand for a foundation for the battery. The work was mostly done after night. When the swamp fort was ready, they built a flat-bottomed scow, put an 8-inch Parrot gun on it, and by aid of the tide floated her into position. Lieu. Nathan Edwards and Col. Serrel laid the line of fire, calculating to put a shell into the rebel headquarters 5½ miles off, and they only missed their mark a few feet. The gun was fired 19 times the first night and did great execution. The fight between the "Swamp Angel," as this gun was called, and the forts continued, and it knocked the whole lower part of the city to pieces. The gun soon burst, and its work ceased. Finally Gilmore ordered Ft. Wagner to be taken by storm, but the confederates evacuated it on the 7th of September, 1863, after a bombardment of three weeks.

C. L. SHIMP.

586. When was a general blown up by a magazine in the moment of his victory? ED. RYNEARSON.

Ans. An American Brigadier General named Zebulon Montgomery Pike, on Lake Ontario, April 27, 1813. The British blew up the fort at York (now Toronto). Some stones sent flying by the explosion mortally wounded him. He died on Chauncy's flag ship, with the British flag under his head by his own request. He was born in New Jersey, in 1779. GEO. L. SHANER.

587. What do the names San Salvador, Santa Cruz, Vera Cruz, La Trinidad indicate? Id.

Ans. —(a) Holy Savior. (b) Holy Cross. (c) True Cross. (d) The Trinity, so named because three mountain summits were first seen from the ship.

E. M. OWENS.

588. Of what illustrious English statesman was it said that "he had a head to contrive, a tongue to persuade, and a hand to execute?"

Ans. I would say William Pitt, the Earl of Chatbam. GEO. L. SHANER.

589. Explain how a person in New York may receive a telegram the day before it is sent from Paris? A. G.

Ans.—The difference of longitude between New York and Paris is about 76° 30' and the difference of time is 5 hr. 6 min.; hence if a telegram is sent from Paris at 1 o'clock A. M. it would reach New York at 8 o'clock P. M. the day before. JOHN H. KNIESLY.

590. Give origin and meaning of the expression, carrying coals to Newcastle. Id.

Ans. Any unnecessary action. Newcastle is the great coal-port of England, hence it would be superfluous to carry coals there. E. M. OWENS.

591. What is gum copal?

L. A. REED.

Ans.—Copal is a name applied to pure gums, often improperly called gum copal. It is a hard, brittle, inodorous resin not easily soluble in alcohol, and is the product of the *Rhus Copallinum* and of the *Elaeocarpus Copaliferus* of the East Indies. See *Brande's Cyclopaedia*. A. L. F.

592. Is the puff-ball a plant? If so, describe its growth. Id.

Ans.—The puff-ball or *Lycoperdon* is a plant, a genus of fungi, of which the common puff-ball may be taken as a representative. These plants grow upon and draw their nourishment, or at least a part of it, from the substance of the object they infest. They are found most abundantly in the moist temperate zones where there is decaying vegetation upon which they feed. The rapidity with which puff-balls increase in size is remarkable, as they sometimes grow from 1 inch to 6 and 12 inches in a single night. D. W. K. MARTIN.

It is a Linnean genus of fungi, now divided into many genera, belonging to the section gasteromycetes, and to the tribe trichospermi. It grows mostly on the ground, is roundish, generally without a stem, is firm and fleshy but afterward powdery within, the powder consisting of the spores, among which are many fine filaments loosely filling the interior of the peridium or external membrane. The peridium finally bursts at the top to allow the escape of the spores, which issue from it as very fine dust. CHARLIE MANN.

593. Why has the U. S. flag a five-pointed star? Give method of drawing such a star. L. B.

Ans.—June 14, 1777, Congress resolved that the flag of the thirteen United States be thirteen stripes, alternate red and white, that the Union be thirteen stars, white on a blue field, representing a new constellation. The design was taken by a committee to Mrs. Ross, who lived on Arch St., Philadelphia, and followed the business of upholstering. The committee asked her to make a flag with thirteen alternate red and white stripes and thirteen six-pointed stars. She immediately took the scissors and cut out a five-pointed star, suggesting that it was more pleasing and symmetrical. The change was accepted. C. A. SEBRING.

594. What room with seven doors and one window is noted in U. S. History? Id.

Ans.—At the close of the Revolution, Gen. Washington had his headquarters in such a room at Newburg, N. Y. It was the dining room in the old "Hansbrouck House." See *Lossing's Field Book*. EDITOR.

595. Give a list of "Famous Rides" with brief incidents. Id.

Ans.—We submit the following, collected from different sources:

Black Valley R. R. Ride— <i>Tarbox.</i>	Parson Allen's Ride— <i>B. F. Taylor.</i>
Charlotte Cushman's Ride— <i>Anna Preston.</i>	Paul Revere's Ride— <i>Longfellow.</i>
Collin Graves's Ride— <i>O'Reilly.</i>	Ride to Aix— <i>Browning.</i>
Erl King's Ride— <i>Goth.</i>	Sheridan's Ride— <i>Read.</i>
Ichabod's Crane's Ride— <i>Irring.</i>	Skipper Ireson's Ride— <i>Whittier.</i>
Israel Putnam's Ride— <i>Magazine.</i>	Tam O'Shanter's Ride— <i>Burns.</i>
King of Denmark's Ride— <i>C. E. Norton.</i>	The Devil's Ride— <i>S. W. Small.</i>
Kit Carson's Ride— <i>Miller.</i>	The Radical Ride— <i>A. J. Walker.</i>
Lady Godiva's Ride— <i>Tennyson.</i>	Warren's Ride— <i>E. H. Weston.</i>
Mary Butler's Ride— <i>B. F. Taylor.</i>	Lochinvar's Ride— <i>Scott.</i>
Mrs. Garfield's Ride— <i>G. L. Taylor.</i>	John Gilpin's Ride— <i>Cowper.</i>
Mrs. Dillard's Ride— <i>Magazine.</i>	Jennie McNeal's Ride— <i>Carleton.</i>

596. Give a rule for finding the day of the week for any date.

Id.

Ans.—First find what day of the week the given date will fall upon this year. Then determine the number of years by subtracting. Divide the number of years by 4. Add the quotient to the number of years. Divide the sum by 7. If there is no remainder the day of the week was the same then as it is now. If there be a remainder count back an even number of days from the day of the week upon which the given date falls this year and the result will be the day of the week that year. Example What day of the week was July 4, 1854? It will be Saturday this year: $1885 - 1854 = 31$, (call it 8 because 31 is nearer 32 than 28); $31 \div 4 = 7$ and 3 remaining; 3 back from Saturday gives Tuesday as the day of the week that year. In case of the even years between the multiples of 4 call each, in dividing by 4, the same as the next higher multiple of 4, but add the quotient to the number itself. A. M. SCRIPTURE.

The following is probably as convenient a rule as any:

. CENTENNIAL RATIOS.

200, 900, 1800, 2200, 2600, 3000	Ratio = 0
300, 1000,	" = 6
400, 1100, 1900, 2300, 2700,	" = 5
500, 1200, 1600, 2000, 2400,	" = 4
600, 1300,	" = 3
700, 1400, 1700, 2100, 2500, 2900	" = 2
100, 800, 1500,	" = 1

MONTHLY RATIOS.

January = 3	July = 2
February = 6	August = 5
March =	September = 1
April = 2	October = 3
May = 4	November = 6
June = 0	December = 1

In leap years January is 2 and February 5, other months as above. Now to the given year add its fourth part, neglecting the remainder; to this add the day of the month, the ratio of the century and the ratio of the month; divide the sum by 7, and the remainder is the number of the day of the week, counting Sunday 1, Monday 2 and so on. Example—Battle of Lexington, April 19, 1775; $75 + 18 + 19 + 2 = 114$; $114 \div 7 = 16$, with a remainder of 2, which brings it on Wednesday.

A. L. FOOTE.

597. Who was "The Inspired Tinker"?

A. G. GUNDER.

Ans.—"The Inspired Tinker" was Jno. Bunyan, author of *Pilgrim's Progress*.
J. H. W. SCHMIDT.

598. Who was called the "Water Poet"?

Id.

Ans.—This title was assumed by John Taylor, an English poet, (1580–1654), who for a long time followed the occupation of a waterman on the Thames. He wrote curious rhymes showing the manners of the times.

JOHN GOTTSCHALL.

599. Must persons be of a certain age before they can get license to teach?

Id.

Ans.—Not in Ohio, but in some states the age of teachers is limited; for example, in Illinois gentlemen must be 19 and ladies 17.

ED. RYNEARSON.

We believe the law in most states requires it, although practically, the exact limitation is not very rigidly enforced.

A. L. F.

600. What were the "Sicilian Vespers?"

JNO. KNIESLY.

ANS.—The name given to the massacre of the French in Sicily, on the day after Easter, 1282, the signal for the commencement of which was to be the first stroke of the vesper-bell. Charles of Anjou, the brother of Louis IX. of France, deprived the Hohenstaufen dynasty of Naples and Sicily and parcelled out these into domains for his French followers; but his cruelty toward the adherents of the dispossessed race, his tyranny, oppressive taxation, and the brutality of his followers, excited among the vindictive Sicilians the deadliest animosity. The aged Giovanna da Procida, a steady partisan of the Hohenstaufen family, took the lead in directing and systematizing a conspiracy against Charles and his followers; and after a visit to Pedro of Aragon (the husband of Constance the cousin of Kouradin, and the next heir to Naples and Sicily), whom he found willing to undertake the conquest of Sicily, he returned to his selfimposed duty in the island. On the evening of Easter Monday the inhabitants of Palermo rose suddenly upon their oppressors, putting to the sword every man, woman, and child of them. This example was followed, after a brief interval, by Messina and the other towns and the massacre soon became general over the island.

E. M. OWENS.

601. What noted events occurred on the 19th of April?

ED. RYNENARSON.

ANS.—APRIL 19, 1775—Is reckoned as the opening of the Revolution.

APRIL 19, 1782—Holland acknowledged the Independence of the U. S.

" 19, 1783—The cessation of hostilities was proclaimed by Washington at the head of the army.

APRIL 19, 1810—The Revolution in Venezuela, S. A., broke out at Caraccas.

" 19, 1837—Gen. Bustanmente was elected president of Mexico. But Santa Anna returned from the U. S. this year in a U. S. ship of war, and regained power as a revolutionary president.

APRIL 19, 1849—The British American League formed in the Canadas to promote popular interests met at Montreal for organization.

APRIL 19, 1861—First bloodshed of the rebellion, at Baltimore.

" 19, 1862—The battle of South Mills was fought.

" 19, 1865—The funeral services of Abraham Lincoln were held at Washington, in the East Room of the White House.

APRIL 19, 1875—The centennial celebration of the battles of Lexington and Concord was the first of these inspiring celebrations, which have had so frequent a place in recent years.

C. A. S.

CREDITS.

A. N. SYMMES, *West Manchester*, 578, 580.

D. W. K. MARTIN, *Webster*, 578, 584, 585, 587, 589, 598, 600, 601.

E. M. OWENS, *German*, 578, 581, 592, 598, 600, 601.

T. A. HUGHES, *New Madison*, 578, 596, 601.

GEO. L. SHANER, *Stewart's Station, Pa.*, 578, 581, 584, 587, 588, 600, 601.

WARREN LOY, *Pymont*, 580, 584, 586, 696, 601.

WM. TAIT, *Greenwich*, 581, 584, 685.

JOHN H. KNIESLY, *Horatio*, 584, 586, 590, 592, 598.

C. L. SHIMP, *Brock*, 585, 589, 601.

J. WOMELSDORF, *Beech Creek, Pa.*, 585, 586, 600.

J. H. W. SCHMIDT, *Columbus*, 587, 698.

A. L. FOOTE, *Hempstead, L. I.*, 593, 597, 598, 599, 600, 601.

LEVI E. RECK, *Greenville*, 598.

GEO. H. THOMAS, *German*, 596, 598, 600.

JOHN GOTTSCHALL, *Gettysburg*, 587, 596, 600, 601.

CHARLIE MANN, " 584, 585, 586, 598, 600, 601.

ED. RYNENARSON, " 580, 584, 585, 586, 589, 591, 596, 698, 600.

PETER MOUL, " 584, 592, 601.

QUERIES.

624. What was meant by saying that, "Clay was in the succession," and when used? ED. RYNEARSON.

625. Who was President from 1787 (the adoption of the Constitution) to 1789? *Id.*

626. Give a rule for laying out a half mile race course with the usual straight sides and curves. A. L. F.

627. Give a short sketch of "The Venerable Bede." M. T. PATE.

628. What general left behind his wooden leg and in what battle? *Id.*

629. What sum of money did our government grant to render the Morse Telegraph possible? WM. TAIT.

630. What was the Tripartite Treaty? JNO. KNIESLY.

631. What Queen was so affected by the failure of her army to take a certain city, that she said its name would be found upon her heart after her death? *Id.*

632. Where is the earliest mention of the earth having orbital motion? A. M. SCRIPTURE.

633. Who wrote "Home, Sweet Home"? *Id.*

634. What are the principal French names in the Miss. valley, and what do they indicate? J. W.

635. Who appoints the "Senators" in the House of Parliament of the Dominion of Canada? J. W.

636. What was Darius Tucker's remedy for the southern rebellion, and what would have been the result if it had been adopted? CORDA SCHELLERT.

637. Why is a horse-shoe considered lucky? A. N. SYMMES.

638. What people are called "arsenic eaters"? *Id.*

639. From what did Mount Vernon receive its name? G. L. SHANER.

640. Who is the sick man of Europe and why so called? B. F. FINKEL.

641. What is the "Atlantis" Theory? *Id.*

642. What was the plan of Iguala? Give incident. CHARLIE MANN.

643. Who was known among the Indians as the Sleepless Chief? *Id.*

644. What Generals were known as the "Iron Man", and "Old Probabilities"? *Id.*

645. In plastered ceilings the location of the laths and joists can be seen on the surface of the plastering by light and dark streaks. Can you account for it? L. B.

BOOK NOTICES.

ANALYTIC ELOCUTION. containing studies, theoretical and practical, of expressive speech. By James E. Murdock. Van Antwerp, Bragg & Co., Cincinnati and New York. Handsomely bound. Contains 504 pp. Price for introduction and sample copy is \$1.00.

This work from the pen of the well-known veteran and accomplished elocutionist, Mr. Murdoch, is the product of careful thought and study, embodying the ripe experience of nearly fifty years of actual practice in this art.

On the stage at the dramatic festival in Cincinnati, 1883, Mr. Murdoch attained the greatest triumph ever won for elocution in this country, by so wielding his cultivated voice that he was better heard than any other actor in the spacious Music Hall. We feel confident that his name will ensure his book a hearty welcome to the oratory-loving people of the whole country.

We consider it the most thorough and complete work on this important subject that has appeared since the publication of Rush's celebrated "*Philosophy of the Human Voice*." Careful attention is given to the *mechanism of the voice* and the means of using the muscles of the throat. *Stress and Inflection* are graphically illustrated, and the five generic properties of the voice—pitch, quality, force, abruptness and time—are treated with mathematical exactness. Seventy pages of well-chosen extracts are furnished for practice.

THE ECLECTIC COMPLETE BOOK-KEEPING. By Ira Mayhew, L.L.D., a well-known author and formerly Superintendent of Public Instruction in Michigan. Published by Van Antwerp, Bragg & Co. Price 50 cents.

This is an exceedingly practical work, its methods having been tested by an experienced teacher. Special attention is given to opening and closing sets of books, and the subject of double entry is clearly elucidated. It is especially adapted to the common schools, and as our children should be taught what they will need and practice in active life, we think this subject should receive attention in every school in the country. We highly commend this book to teachers who desire to introduce the study.

THE ECLECTIC PRIMARY HISTORY OF THE UNITED STATES. By Edward S. Ellis, Supt. of Schools, Trenton, N. J. Published by Van Antwerp, Bragg & Co. Sample copy 50 cents.

Here is a charming little book giving concisely the history of our country from its discovery to the present time. It chronicles in simple language the leading events, and shows the wonderful progress of the United States. It has 224 pages with 107 illustrations, making this volume very attractive and useful to those pupils whose opportunities prevent them from pursuing the study more extensively. We consider it not only a good text-book with questions, but it could also be used to a good advantage for supplementary reading.

NEW PHYSICAL GEOGRAPHY. For Grammar and High Schools, and Colleges. By James Monteith. A. S. Barnes & Co., New York and Chicago. Price \$1.25.

The study of physical geography is made very pleasant and profitable with such an attractive book. It is neat, well arranged and beautifully illustrated, with clear and concise statements embracing the most recent discoveries in Physiography, Hydrography, Meteorology, Terrestrial Magnetism and Vulcanology. A feature of special interest will be "*The Record of Recent Geographical Discoveries*," which contains brief accounts of the explorations of De Long, Greely and others. It will be a favorite with pupils and teachers, not only of the Grammar schools but it will be found well adapted for use in the High and Normal schools.



EDITED BY

JOHN S. ROYER.

VOL. VI.

JUNE, 1885.

No. 6.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

715. *By the Editor.* A gravel walk is to be made half round a rectangular garden 100 feet long and 80 feet wide; what must be the width of walk so as to take up half the area of the garden?

By LEWIS McKIBBEN, Springfield, Ohio.

Work all such problems by this rule: Add the length of side and end of the garden, deduct the length of the diagonal of the garden and divide by 2, for the width of the walk. Thus, in this case,

$$[100+80-\sqrt{(100^2+80^2)}]\div 2=25.97+, \text{ width of walk.}$$

Solved thus by J. W. Jones and A. M. Scripture.

By J. W. PFEIFFER, Bolivar, Ohio.

Let x = width of walk, x^2 = area of walk in either corner of the rectangle; also $(100-x)x$ and $(80-x)x$, area of remaining parts of walk. Hence, $x^2+(100-x)x+(80-x)x=4000$. Reducing,

$$x^2-180x=-4000. \therefore x=25.968758 \text{ ft.}$$

Solved in like manner by Messrs. Parsons, Schmidt, Martin, Russell, Foote, Reed, Harvey, Harvill, Corbin, Scripture, Wood, Smith, Wiley, and Heironimus. Geometrically by T. L. Brewer.

By D. W. K. MARTIN, Webster, Ohio.

Conceive 4 such gardens placed so that the side of garden No. 1 and the end of No. 2 form the side of a square; the side of No. 2 and the end of No. 3 form a side of the same square; also side of No. 3 and end of No. 4 form a side, and side of No. 4 and end of No. 1 form a side of the same. Then we have another square $ABCD$ which is enclosed by the four gardens whose side is 20 ft. and area 400 sq. ft. Hence the entire square contains $100 \times 80 \times 4 + 20^2 = 32400$ sq. ft., and the area of a walk extending all around the square occupying half of the four gardens is $100 \times 80 \times 4 \div 2 = 16000$, and side of part remaining is $\sqrt{(32400-16000)} = 128.06$ and $(180-128.06) \div 2 = 25.97$ ft., width of walk.

Solved thus by B. F. Finkel, J. C. Gregg, G. H. Thomas and Ed. Rynearson.

716. *By Request.*—A has a garden in the form of an equilateral triangle. From the corners to a spring within the garden, the distances are $a=20$, $b=28$ and $c=31$ rods. Find side of the garden.

By H. GUNDEE, New Castle, Ind.

Let A , B and C be the corners of the garden from which a , b and c are measured, and O be the spring. From O draw perpendiculars on the sides AB , BC and CA and let E , F , G be the feet of these on the sides AB , BC and CA , respectively, and put x , y and z = to their respective lengths. Then since angles A , B and C each $= 60^\circ$, the angles $EOF = FOG = GOE = 120^\circ$ each, and $EF = \frac{1}{2}b\sqrt{3}$, $FG = \frac{1}{2}c\sqrt{3}$, $GE = \frac{1}{2}a\sqrt{3}$. It is easily shown that in the triangle EFG

$$x^2 + xy + y^2 = \frac{3}{4}b^2 \dots (1), \quad x^2 + xz + z^2 = \frac{1}{4}a^2 \dots (2),$$

$$y^2 + yz + z^2 = \frac{3}{4}c^2 \dots (3).$$

From (1), (2) and (3)

$$xy + yz + xz = \sqrt{\left[\frac{3}{8}(a^2b^2 + a^2c^2 + b^2c^2) - \frac{3}{16}(a^4 + b^4 + c^4)\right]} = p.$$

Adding (1), (2), (3), and 3 times (4) and dividing by 2, and extracting square root we get $x + y + z = \sqrt{\left[\frac{3}{8}(a^2 + b^2 + c^2) + \frac{3}{2}p\right]} \dots (5)$. If $AB = BC = CA = n$, we have

$$n = (x + y + z)\sqrt{\frac{4}{3}} = \sqrt{\left[\frac{1}{2}(a^2 + b^2 + c^2) + 2p\right]} \dots (6).$$

Putting in the value of p

$$n = \sqrt{\left[\frac{1}{2}(a^2 + b^2 + c^2) + \frac{1}{2}\sqrt{6(a^2b^2 + a^2c^2 + b^2c^2) - 3(a^4 + b^4 + c^4)}\right]} \dots (7).$$

Substituting the numbers for a , b and c , $n = 45.933 +$ rods.

G. H. Harvill, Wm. Wiley, Lewis McKibben, T. N. Haun, J. W. Jones, A. L. Foote, J. W. Pfeiffer, H. A. Wood, A. M. Scripture, J. E. Dabe, S. G. Cagwin, and J. C. Corbin.

717. *By Request.*—How long before due must a bank discount a note at 6% in order to receive for its money a discount equal to 10% interest?

By PROF. H. A. WOOD, 204 East 51st Street, New York.

The proceeds of the note $= \frac{6}{100}$ or $\frac{3}{50}$ of the face, since the discount is 6% on the face of the note, or 10% on the proceeds of the note; the discount is, therefore, $\frac{3}{50} = 40\%$ of the face; 40% discount at 6% per annum will require $40 \div 6 = 6\frac{2}{3}$ years.

Solved thus by Messrs. Gregg, Jones, and Pfeiffer.

By PROF. GEO. C. RUSSELL, Woodland, Cal.

Assume \$1 as the bank discount of a note at 6%. Then \$1 will be the interest on proceeds at 10%; $\$1 \div 6\% = \$16\frac{2}{3}$, the face of the note; $\$1 \div .10 = \10 , the proceeds, or principal on which interest is to be reckoned; $16\frac{2}{3} - 10 = \$6\frac{2}{3}$, the interest for the required time; $\$10 \times .10 = \1 , interest for 1 yr.; $6\frac{2}{3} \div 1 = 6\frac{2}{3}$ yrs.

Solved algebraically by Messrs. Reed, Foote, Pond, Martin, Bartlett and McKibben.

718. By making 2% more on sales, A gains \$100 more per annum than B. If each has \$5940 at the close of a year's business, determine their rate of gain and each one's annual profits.

By CHARLES M. SMITH, *Byron Center, N. Y.*

Let x = B's profit in dollars, $\$100 + x$ = A's profit, $\$5940 - x$ = B's original capital, $\$5840 - x$ = A's original capital; $(100 + x) \div (5840 - x) - [x \div (5940 - x)] = \frac{1}{50} \dots (1)$; $x^2 - 11780x + 4989600 \dots (2)$; $x = 440$ or $11340 \dots (3)$. The latter value of x is only applicable when the original capital of each is negative. Substituting 440 for x in $x \div (5940 - x)$, we have $\frac{8}{100}$ as the result. Hence, $\$540$ = A's profit, $\$440$ = B's profit, 8%, B's rate of gain, 10%, A's rate of gain.

Wm. Wiley gave a similar solution with same result. Others get different results.

719. A and B rent 12 acres of pasture for 8 weeks, paying \$90. A is to pay for the grass already on the field and B. for what grows during time of pasture. How many cattle can each turn in, if 4 acres together with what grows during time of pasture, would keep 12 oxen 6 weeks, and similarly five acres would keep 35 oxen 2 weeks?

By A. L. FOOTE, *Hempstead, Long Island.*

Let x = growth in acres on each acre for one week. Then 12 oxen in 6 weeks eat 4 acres and $24x$ acres growth (1), and 35 oxen in 2 weeks eat 5 acres and $10x$ acres growth (2). From (1), 1 ox in 1 week eats $\frac{1}{3}$ acres and $\frac{2}{3}x$ acre growth (3). From (2) 1 ox in 1 week eats $\frac{5}{7}$ acre and $\frac{2}{7}x$ acre growth (4). But (3) = (4) or $\frac{1}{3} + \frac{2}{3}x = \frac{5}{7} + \frac{2}{7}x$ (6), from which $x = \frac{1}{2}$ acre growth on each acre per week. Now the quantity to be eaten in 8 weeks is 12 acres + $96x$ acres growth or $12 + 96 \times \frac{1}{2} = 20$ acres. Now 1 ox, in 1 week, eats $\frac{1}{3} + \frac{2}{3}x$ or $\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$ of an acre, and in 8 weeks $\frac{16}{3}$ of an acre; hence the number of oxen to eat 20 acres is $20 \div \frac{16}{3} = 30$. And we readily find that A turns in 18 oxen and B 12.

Wm. Wiley, J. C. Gregg and Fred. Stauffer solved it. We corrected a misprint in problem and modified the solution.

721. A cistern can be filled in 2 hr. 8 min. by a pipe $\frac{5}{8}$ of an inch in diameter. In what time can it empty the cistern if a half-inch pipe be running into the cistern at the same time?

By WM. WILEY, *Detroit, Mich.*

Since the quantity carried by the pipes is as the squares of their diameters, the filling pipe has $\frac{16}{25}$ capacity of the discharging one, which reduces the capacity of the discharging pipe to $\frac{9}{25}$ of its power. It will, therefore, empty the cistern in $\frac{25}{9}$ of 128 min. = 5 hr. 55 $\frac{5}{9}$ min.

J. H. Drummond, J. C. Gregg, Chas. M. Smith, S. P. Bartlett, A. L. Foote, W. L. Harvey and G. W. Leahy solved it.

722. If 4 men saw 15 cords of oak in the same time 5 men saw 14 cords of hickory, and if 3 men saw 18 cords of hickory in 3 days at 12 hours each, how many hours a day must 7 men work to saw 90 cords of oak in 6 days?

By A. L. FOOTE, Hempstead, Long Island.

Four men saw 15 cords of oak in the same time 5 men saw 14 cords of hickory and 20 men saw 75 cords of oak in the same time 20 men saw 56 cords of hickory. Therefore, 75 cords of oak are equivalent to 56 cords of hickory and 90 cords of oak are equivalent to $67\frac{1}{2}$ cords of hickory. Now if 3 men saw 18 cords of hickory in 3 days of 12 hours, 1 man saws 6 cords in the same time and in 1 day of 12 hours 1 man saws 2 cords and 7 men saw 14 cords in 12 hours and in 1 hour $1\frac{1}{2}$ cords, then to saw $67\frac{1}{2}$ cords requires $67\frac{1}{2} \div 1\frac{1}{2} = 2\frac{2}{3}$ hours and this comprised in 6 days gives $\frac{1}{6} \times 2\frac{2}{3} = 9\frac{2}{3}$ hours a day.

By JOHN C. GREGG, A. M., Brazil, Ind.

A man can saw $1\frac{1}{2}$ cords of oak or $1\frac{1}{5}$ cords of hickory in one day. Hence the hardness of hickory is to the hardness of oak as $1\frac{1}{5} : 1\frac{1}{2}$ or as 75 : 56, and we may now arrange the hardness as an element of the problem. Arranging terms in a compound proportion, we have

$$\begin{array}{rcl} 7 & : & 3 \\ 18 & : & 90 \\ 75 & : & 56 \\ 6 & : & 3 \end{array} \quad : : 12 : 9\frac{2}{3} \text{ hrs., ans.}$$

Solved by Wm. Wiley and Chas. M. Smith.

723. A ladder 10 feet long stands close against a vertical wall. If the lower end is drawn out and the upper slides down the wall until the ladder assumes a horizontal position, through what distance will the middle point move?

By WM. WILEY, Detroit, Mich.

As every right triangle is inscriptible in a semicircle whose diameter is the hypotenuse, the center of the hypotenuse or ladder always maintains the same distance from the right angle or foot of the wall, viz., $\frac{1}{2}$ the length of the ladder. The middle point, therefore, moves through a quadrant of a circle, whose radius is 5, or $10 \times \frac{1}{4}\pi = 7.854$ ft.

W. L. Harvey, J. C. Gregg, S. P. Bartlett, A. L. Foote, John H. Kniesly and Chas. Mann solved it.

724. How many balls in a pile whose base is a square, with 20 on each side?

By W. L. HARVEY, Maxfield, Me.

The pile will consist of 20 square numbers; that is, 20^2 , 19^2 , 18^2 , etc., to 1^2 . The sum of the series is then required from 1^2 to 20^2 . The formula for the sum of a series of square numbers is

$$s = n(n+1)(2n+1) \div (1 \times 2 \times 3). \quad \text{If } n = 20, s = 2870.$$

Solved by Messrs. Harvill, Foote, Smith, Bartlett, Wiley, Drummond, Haun, Mann, Kniesly, Cagwin and Debery.

725. A boy starts from G for L at the same time a man starts from L for G. Each travels at a uniform speed and they meet at noon. The boy reaches L at 5 P. M. and the man arrives at G at 12 min. past 7 P. M. When did they start?

By CHARLES M. SMITH, *Byron Center, N. Y.*

Let GL be the line connecting the points G and L , and let M be the meeting point between G and L . Let x = No. of hours in which each travels to M . The No. of hours in which boy travels GM is to the No. of hours in which he travels ML , as the No. of hours in which the man travels GM is to the No. of hours in which he travels ML . $\therefore$

$$x : 5 :: 7\frac{1}{2} : x, \text{ whence } x = 6.$$

Hence they start 6 hours before noon, or at 6 o'clock, A. M.

A. L. Foote, J. C. Gregg, W. L. Harvey, M. T. Mooney and G. W. Leahy also solved it.

726. By B. F. FINKEL, *Commercial Point, Ohio.*—There is a row of perfectly elastic balls in a geometrical progression, whose common ratio is 3; the first impinges on the second which transmits its velocity to the third, and so on; the last ball moves off with $\frac{1}{6}$ of the velocity of the first. Required, the number of balls.

By A. L. FOOTE, *Hempstead, Long Island.*

Let A be the first, B the second, and so on; then we have for the motion of B , by the impact of A , $2A \div (A+B)$ or $(2 \times 1) \div (1+3) = \frac{1}{2}$; and in like manner B impinging on C , the motion of C is $\frac{1}{4}$, and D $\frac{1}{8}$, etc., to $\frac{1}{64}$; therefore, we must have 7 balls.

727. By the same.—Find the edge of the largest possible cube that can be cut from a hemisphere 6 inches in diameter.

By HON. JOSIAH H. DRUMMOND, *Portland, Me.*

Let x = side of cube. As the cube rests on the base of the hemisphere, the center of base of cube and center of base of hemisphere coincide. The distance from this center to either upper corner of cube equals radius of base of hemisphere. But $\frac{1}{2}x^2 + \frac{1}{2}x^2$ = square of distance of center from either lower corner of cube. Hence, $\frac{1}{2}x^2 + \frac{1}{2}x^2 + x^2 = 9$, square of radius, and we have $x = \sqrt{6} = 2.4494897$ in.

Solved by M. T. Mooney, J. C. Gregg, J. W. Jones, W. L. Harvey, S. P. Bartlett, A. L. Foote, Wm. Wiley, Gordon Dinsmoor and J. C. Roebuck.

728. By the same.—Find the base and perpendicular of a right-angled triangle, having given the hypotenuse = 35 ft. and the side of inscribed square = 12 ft.

By T. N. HAUN, *Midway, Tenn.*

Let x and y be the sides of the triangle. Then we get

$$x^2 + y^2 = 35^2 = 1225 \dots (1), \quad x + y = \frac{1}{2}xy \dots (2).$$

Squaring (2), and combining with (1), $x^2y^2 - 288xy = 176400 \dots (3)$.
 $\therefore xy = 588 \dots (4)$. From (4) and (2), $x+y=49 \dots (5)$. From
 (5) and (1), $x=21, y=28$.

By S. G. CAGWIN AND G. W. SUBLETTE.

Let $h = 35$, the hypotenuse, $s = 12$, side of inscribed square, $x =$
 base and $y =$ perpendicular. Then

$$x-s : x :: s : y, \text{ or } xy = s(x-y) \dots (1), \text{ and } x^2 + y^2 = h^2 \dots (2).$$

Adding twice (1) to (2), we get

$$x^2 + 2xy + y^2 = 2s(x+y) + h^2, \text{ or } (x+y)^2 - 2s(x+y) = h^2 \dots (3).$$

Whence $x+y = s + \sqrt{(s^2 + h^2)} \dots (4)$. Substituting (4) in (1) we get

$$xy = s^2 + s\sqrt{(s^2 + h^2)} \dots (5).$$

From the square of (4) take 4 times (5), and we have

$$x^2 - 2xy + y^2 = h^2 - 2s^2 - 2s\sqrt{(s^2 + h^2)} \dots (6).$$

Extracting square root, we have

$$x-y = \sqrt{[h^2 - 2s^2 - 2s\sqrt{(s^2 + h^2)}]} \dots (7).$$

Taking half the sum of (4) and (7), and also their difference, we get

$$x = \frac{1}{2}\{s + \sqrt{(s^2 + h^2)} + [h^2 - 2s^2 - 2s\sqrt{(s^2 + h^2)}]^{1/2}\} = 28,$$

$$\text{and } y = \frac{1}{2}\{s + \sqrt{(s^2 + h^2)} - [h^2 - 2s^2 - 2s\sqrt{(s^2 + h^2)}]^{1/2}\} = 21.$$

Excellent solutions were furnished by G. H. Harvill, Wm. Wiley, J. W. Jones,
 M. T. Mooney, J. H. Drummond, Alex. Knisely, W. L. Harvey and A. L. Foote.

729. By PROF. H. A. WOOD, *New York*.—Show that the area of a regular in-
 scribed dodecagon is equal to three times the square on the radius.

By G. W. LEAHY, *Marshallville, Ohio*.

In any circle describe a regular hexagon and draw radii to its an-
 gles. Bisect all its sides by radii and connect their outer extremities
 with the angles of the hexagon and there will then be inscribed a reg-
 ular dodecagon. It will be seen that the dodecagon is composed of
 twelve equal triangles, each base being the radius, and each altitude
half the radius (for each altitude is half the side of the regular in-
 scribed hexagon which is equal to the radius). Representing the ra-
 dius by R , we have area of one of these triangles $(R \times \frac{1}{2}R) \div 2 = \frac{1}{4}R^2$,
 and the area of the twelve triangles is $\frac{1}{4}R^2 \times 12 = 3R^2$.

By JOHN C. GREGG, A. M., *Brazil, Ind.*

Let $r =$ radius of circle. We easily find the area of the inscribed
 hexagon to be $\frac{1}{2}(3r^2\sqrt{3})$, and the area of the circumscribed hexagon
 to be $2r^2\sqrt{3}$. Calling these p and P , we have by Loomis' Geometry,
 Book VI., Prop. VIII., $p : p' :: p' : P$, where p' is the dodecagon
 required; whence $p' = 3r^2$.

Chauvenet in his geometry gives a beautiful demonstration of this.

Chas. M. Smith, J. H. Drummond, Wm. Wiley and A. L. Foote gave elegant
 demonstrations.

730. By N. R. OLIVER, *Dorchester, Ont.*—The diameter of the circumscribing circle of a right triangle added to the diameter of the inscribed circle is $71\frac{3}{4}$, and the perpendicular is $\frac{3}{4}$ of the base; required the sides without the application of algebra.

By WM. WILEY, *Detroit, Mich.*

The diameter of circumscribed circle is the hypotenuse. Hence, the sides are some multiple of 3, 4 and 5. The diameter of the inscribed circle is 4 area divided by sum of sides is $\frac{2}{1}\frac{1}{2}$ or 2; if we consider the sides as 3, 4 and 5, the sum of the two diameters is 7. In the problem, it is $71\frac{3}{4}$. $\therefore$ the required multiple is $4\frac{1}{4}$, and the sides are $30\frac{3}{4}$, 41 and $51\frac{1}{4}$.

Also solved by Messrs. Foote, Harvey, Smith, Stauffer, Mooney, Leahy and Drummond.

Problems for Solution.

745. By W. L. HARVEY, *Marfield, Me.*—A man drops a shell from a balloon which explodes on reaching the ground. It takes the sound after the explosion as long to reach him as the shell is falling. If sound moves 1120 feet per second, how high was the man from the earth?

746. By J. C. ROEBUCK, *Rock Falls, Iowa.*—In how many different ways can a man travel from one corner of a township 6 miles square to the opposite corner, following section lines.

747. By the same.—If solvable, how many rows with $b=5$ trees in a row can be planted with $a=33$ trees?

748. By G. H. HARVILL, *Ada, La.*—Required the length of the diagonal of a cube the length of whose side is S .

749. By T. L. BREWER, *Mt. Heron, Ohio.*—How much will a solid cast-iron pillar 10 feet high and 4 inches in diameter, support at its upper end when fixed at the other?

750. By A. F. PARSONS, *Arroyo Grande, Cal.*—Divide a given semi-circle into two equal parts by a line at an angle σ with the diameter.

751. By H. A. WOOD, *New York City.*—If r be the radius of a circle, how far from the center must a chord be drawn parallel to the diameter to divide the semi-circle into two equal parts?

752. By WM. WILEY, *Detroit, Mich.*—Suppose x and y are integers. It is required to find integral values for $xy \div [x+y]$.

753. By the EDITOR.—At what time between 12 and 2 o'clock is the minute hand as far from I. as the hour-hand is from XII?

754. By a farmer.—The base of a pyramidal stone is 4 by 15; the slant heights of two edges are 13 each, and the other two edges are 14 each. Locate the center of gravity.

755. By L. B. FRAKER, *Pettisville, Ohio.*—The vertical angle of a triangle is given in magnitude, and the vertex of the triangle is in the circumference of a circle given in magnitude and position; also, the base of the triangle is in a straight line given in position, and one extremity of the base is given in position. It is required to determine the triangle when the base is a minimum.—Hallowell. Make a numerical application.

756. By H. A. WOOD.—Given $xy=300x+125y$ and $x^2-y^2=90000$. Find x and y by brief process.

Solutions should be received on or before July 4.

ENGLISH GRAMMAR.

Parse all italicized words, and explain difficulties.

J. W.

1. *The Roundhead's and the Parliament's forces were soon engaged.*

ANS.—*The* modifies the nouns in the possessive case.

2. *The more I sing the better I like it.*

ANS.—*The more* and *the better* are best parsed as adverbial phrases, modifying *sing* and *like*, respectively. Or call *the* (from the Anglo-Saxon *thy, that*, being different from the common article *the*, according to Latham.) an adverb, modifying *better* and *more*. Then *better* is an adverb modifying *like*, and *more* may be called an adjective limiting the object understood of *see*.

3. O bosom, black as death!

O limed soul! *that struggling* to be free,
Art only more engaged. Help, Angels, *make assay*!
Bow stubborn knees! and heart with strings of steel,
Be soft as sinews of the new-born babe.

ANS.—*That* is a relative pronoun; its antecedent is *soul*; it is the subject of *art engaged*.

Struggling is a present participle, limiting *that*.

Only is an adverb, modifying *more*.

Make is a transitive verb, having *ye* understood for its subject, and governing the noun *assay* in the objective case.

Bow is an intransitive verb, imperative mode, agreeing with its subject *you* understood in person and number.

Be is a copulative verb, imperative mode, present tense; its subject is *you* understood.

4. When an article precedes the possessive case does it limit the the noun in the possessive case?

ANS.—Yes.

Please answer the following in *Visitor*.

J. C. ROEBUCK.

1. Is *If I was you* wrong? If so, why?

ANS.—The past form of the subjunctive expresses a wish or supposition, and implies that the opposite of the thing wished or supposed is really the case: as, *If I were you*. Oh that he *were* innocent. *If I were* now as strong as I was a year ago, I would begin the work. But if the past indicative is used instead of the past subjunctive, it implies that the thing is really the case: as, *If I was a spy*, I still had rights, *If I was* the prisoner, you had no right to interfere.

2. Analyze—*I saw him do it.*

ANS.—*I* is the subject; *saw* the predicate, modified by *him*, and *him* by [*to*] *do*, and *do* by *it*.

3. Is not the infinitive in 6th sentence (adverbs), p. 65, April No., objective?

ANS.—In the sentence (*I determined early in the morning to see the parent*) to which you refer, *to see* has the construction of an adverb, limiting the intransitive verb *determined*.

Please parse the underlined words for me.

J. A. ROACH.

John has let his *hat drop* into the pond. The *sun* is said *to have been eclipsed*.

Ans.—*Hat* is a common noun, of the neuter gender, third person, singular number; it is in the objective case, object of *has let*.

Drop is a regular intransitive verb; infinitive mode, present tense; it has the construction of an adjective, limiting *hat*. It may be considered the attributive object of *has let*, but it refers to *hat*.

Sun is a common noun, of the neuter gender, third person, singular number, nominative case; it is the subject of *is said*.

To have been eclipsed is a regular transitive verb, passive form, infinitive mode, present perfect tense, and has the construction of an adjective, in the predicate with *is said*, but referring to the subject *sun*.

Examination Questions.

ARITHMETIC.

1. From the quotient of $12.9 \div 8.256$, take $\frac{1}{3}$ reduced to a decimal; divide the remainder by 25 millionths; multiply the quotient by 8 ten-thousandths; and divide the product by 1.25. Ans., 28.

2. Yesterday I was in longitude $86^{\circ} 18' W$. and set my watch; to-day the sun is on the meridian at 36 min. past 11 o'clock. What is my longitude?

Ans.—Difference of time is 24 min., which reduced to longitude is $24 \times 15 \div 60 = 6^{\circ}$; hence my longitude is now 6° less, or $80^{\circ} 18' W$.

3. The amount of a certain principal for 1 yr. 9 mo. 18 da. is \$165. Find the principal and rate, if the interest is $\frac{3}{8}$ of the principal.

Ans.—Dividing the amount, \$165, into two parts as 3 to 8, we get \$45 for the interest and \$120 for principal. Hence the interest for one year is $45 \div 1\frac{3}{8} = \$25$, and the rate $25 \times 100 \div 120 = 20\frac{5}{8}\%$.

4. Sold a horse and a cow for \$210; on the horse I gained 25% and lost 25% on the cow; what was my gain if the cow cost $\frac{3}{8}$ as much as the horse.

Ans.—Let $100\% = \text{cost of horse}$ and $66\frac{2}{3}\% = \text{cost of cow}$; then I received for both ($\frac{3}{8}$ of 100%) $\div$ ($\frac{3}{4}$ of $66\frac{2}{3}\%$) $= 175\%$, or \$210; $\therefore$ the horse cost $\$210 \times 100 \div 175 = \120 , the cow $\frac{3}{8}$ of $\$120 = \80 , and my gain was \$10.

5. Paid \$199.50 for a bill of goods at 20, 12 $\frac{1}{2}$ and 5% off. Find the list price.

Ans.—The list price was $\$199.50 \div .95 \div 87\frac{1}{2} \div 80 = \300 .

6. Find the cost of polishing the surface of the largest cube that can be cut from a spherical piece of granite 20 inches in diameter, at 5 cents per square inch.

Ans.—The diagonal of cube is 20 inches; hence $20^2 \div 3 \times 6 \times .05 = \40 , cost.

7. In a pair of false scales, a body weighed 32 lbs. avoirdupois in one pan, but only 22 lbs. 12 $\frac{1}{2}$ oz. in the other. What was the true weight?

Ans.—The true weight is a mean proportional between the two given weights; hence we have $\sqrt{(32 \times 22\frac{1}{2})} = 27$ lbs.

8. I have a cylindrical piece of lead 8 inches in diameter and 18 inches long. Not allowing for wastage in moulding how large a cannon ball could be made with the lead?

Ans.—The amount of lead is $8^2 \times \frac{1}{4} \pi \times 18 = 288\pi$; hence the diameter of ball would be the cube root of $(288\pi \div \frac{1}{4} \pi) = 12$ inches.

9. Required the length of a hand rail for a flight of stairs of 18 steps, each step being 7 inches high and 9 $\frac{1}{8}$ inches wide.

Ans.—The length is the hypotenuse of a right-angled triangle whose base is $18 \times 9\frac{1}{8} = 168$ in. and perpendicular $18 \times 7 = 126$ in.; the rail is, therefore, $\sqrt{(168^2 + 126^2)} = 210$ inches, or 17 $\frac{1}{2}$ feet.

10. A man agreed to work a year for a horse and \$120, at the end of the 5th month he quit, and received the horse and \$8. Find the value of the horse.

Ans.—In 5 months he earned $\frac{5}{12}$ of the value of the horse and $\frac{5}{12}$ of \$120 or \$50; but he received the horse and \$8; hence $\frac{1}{12} - \frac{5}{12} = -\frac{4}{12}$ of the value of the horse must be $\$50 - \$8 = \$42$, and its value is \$72.

GEOGRAPHY.

1. What large rivers rise in or near Switzerland?
2. In what river system does Lake Victoria discharge its waters? Lake Chautauqua?

Ans.—The Nile. The Mississippi, as the outlet at Jamestown, N. Y., reaches a branch of the Alleghany River.

3. Mention number of degrees between the Polar circles, and tell how you arrive at the number.

4. Why are the Tropics plac'd where they are, and where are they?

5. Give water-route from Liverpool to Calcutta.

6. Locate Kabul, Hong Kong, Kelat, Penjdeh and Oklahoma.

Ans.—These are points of interest and should be understood by teachers. *Kabul* and *Penjdeh* are towns in Afghanistan, the scene of rivalry between England and Russia in their advances into Central Asia. *Penjdeh* is situated on a broad plateau, and is a strong position for defence; it is about 130 miles northeast of Herat. *Kelat* is a town in Beloochistan. *Hong Kong* is a city in China. *Oklahoma* is an unoccupied country in the central part of Indian Territory, containing about 6,000,000 acres; it has lately excited considerable interest.

7. What effect will the war between England and Russia have on the trade with America?

8. What can you say of the Nile river, the cities on it, its branches, and the country drained by it?

9. What state of our country leads in the product of wheat? Corn? Gold? Wool? Petroleum?

10. Which is farther north, Toledo or St. Petersburg?

HISTORY.

1. In what war did the French lose control over their possessions in America?

Ans.—French and Indian war.

2. From the colonists of which country did we get our language, laws and literature?

Ans.—England.

3. What were the causes of the War of 1812?

Ans.—The Embargo Act and the Impressment of American Seamen.

4. Give a list of what you consider the important events in the history of this nation.

Ans.—Declaration of Independence as its origin, Adoption of the Constitution, Purchase of Louisiana, Treaty of Hidalgo, Civil War, Abolition of Slavery, and many other events of equal importance.

5. Whence came the mound builders? What traditions and facts throw light on their origin?

6. Describe Jay's treaty, and the difficulties connected with it.

7. What victories were obtained by Capt. James Lawrence? How was he killed?

Ans.—He served under Commodore Decatur in the Mediterranean, where he assisted in efficient work, and afterwards appointed successively to command the *Vixen*, the *Wasp*, the *Argus* and the *Hornet*. In 1813 he captured the *Peacock* from the British, which gave him honor. June 1, 1813, only a few days after becoming commander of the frigate *Chesapeake*, he encountered, near Boston, the British frigate *Shannon*, and after a severe contest, in which his crew was found poorly disciplined, he was mortally wounded, and the British took his vessel. It was on this occasion that he uttered those memorable words, "Don't give up the ship."

8. How did communism show itself in the riots of 1877?

9. How is the District of Columbia governed?

10. Give an account of the battle of Antietam. Name the commanding generals.

GRAMMAR.

1. Express the different degrees of comparison in which *last*, *next* and *most* are found.

Ans.—Late, later, latest or last; nigh, higher, highest or next; much, more, most.

2. Give examples of the proper use of *lie*, *lay*, *sit*, *set*, *to* and *too*.

Ans.—The cattle *lie* on the grass. *Lay* a sure foundation. *Set* the dish where I expect to *sit*. He came *too* late *to* take the train.

3. Correct: (1) Either he or I is to blame: (2) They are wolves in sheep's clothing. (3) I, he and you committed the crime. (4) Who do you suppose me to be?

Ans.—In (1), *is* should be *am*: (2) *sheep's*; (3) *I, you* and *he*; (4) *whom*.

4. Write correctly in all respects—The result however of the three years reign of tyranny of James II was that William of Orange came over from Holland and without shedding a drop of blood became a King of England.

Ans.—The result, however, of the three years' reign of tyranny of James II, was that William of Orange came over from Holland and, without shedding a drop of blood, became, A. D. 1688, William III. of England.

5. Diagram—Learn well to know how much need not be known, And what that knowledge which impairs your sense.

you	well	[]	much	how
learn			not	
	to know	need	to be known	
		and	that	
		knowledge	which	
			impairs	sense
		is—what		your

6. Parse—Such a man *were* one for whom a woman's heart should beat constant while he lives and break when he dies.

Ans.—*Were* is a copulative verb, subjunctive mode, past form but alluding to the present, and agrees with its subject *man* in the third person and singular number.

One is a numeral adjective, modifying *man* understood.

For is a preposition, showing the relation of *whom* to *should beat* and *should break*.

A is an indefinite article, belonging to *woman's*.

Constant is an adverb (adjective form) and modifies *should beat*.

While is a conjunctive adverb; it limits *lives*, and joins the clause to *should beat*.

7. Scan—I now lament the vanished ray

That scattered gladness o'er my path.

Ans.—It is Iambic Tetrameter.

8. Write one page as a sample of your composition, discussing disputed points in grammar.

SPELLING.

Cerulean, quinsy, partisan, palate, ipecac, seignior, tautology, rancorous, debile amanuensis, shamponing, Afghanistan, beneficial, precedent, coadjutor, commandant, braggart, coruscations, cotillion, librettos.

NOTE.—Your editor offers the above as a substitute for the regular county list, as the June examination will not be till the 6th, the list for which will be published in July number. Study this well.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

603. Who was Wouter Van Twiller, and what noticeable features did he possess? GEO. L. SHANER.

Ans.—Wouter Van Twiller was Governor of New York from 1632 to 1638, when he was recalled by the Dutch West India Company. Irving has thus sketched this redoubtable governor: "He was exactly five feet six inches in height, and six feet five inches in circumference. His head was a perfect sphere, and of such stupendous dimensions that dame Nature, with all her sex's ingenuity, would have been puzzled to construct a neck capable of supporting it; wherefore she wisely declined the attempt, and settled it firmly on the top of his backbone just between the shoulders. His body was oblong and particularly capacious at bottom, which was wisely ordered by Providence, seeing that he was a man of sedentary habits and very adverse to the idle labor of walking. His face—that infallible index of the mind—presented a vast expanse, unfurrowed by any of those lines or angles which disfigure the human countenance with what is termed expression. Two small gray eyes twinkled feebly in the midst, and his full-fed cheeks, which seemed to have taken toll of every thing that went into his mouth, were curiously mottled and streaked with dusky red, like a Spitzenberg apple."—*McCabe's History of the U. S.*

JOHN H. KNIESLY.

Wouter Van Twiller was a Dutchman, who was born at Rotterdam. In 1629 he was appointed governor of Nieuw Nederlandts, and in June arrived at New Amsterdam (N. Y. City). In person he was short and sturdy. He was very regular in his habits, seldom spoke save in monosyllables, and was a constant smoker.

J. W. CORBIN.

604. What is the Golden Rule of the Arithmetic?

M. A. BROWN.

Ans.—Proportion was formerly so extensively used that it was often called *The Golden Rule*. It was also styled the *Rule of Three*, because three terms are given to find the fourth.

CHAS. BIGLER.

605. Where was Washington when he assembled his officers and bade them a final adieu?

Id.

Ans.—The officers having previously assembled in New York for the purpose Gen. Washington now joined them; his words on this occasion were few but full of feeling and affection. "With a heart full of love and gratitude, I now take my leave of you. I most devoutly wish that your latter days may be as prosperous and happy as your former ones have been glorious and honorable." Having thus affectionately addressed them, he now took each by the hand and bade him farewell.

CHAS. BIGLER.

606. How many maxims did Washington write for his own use? Give them. How old was he then? What were his last words? *Id.*

Ans.—Gen. Washington's last words (to Dr. Craik) were, "It is well," and his maxims as we have them, are as follows:

1. Speak not ill of the absent, it is unjust.
2. Commerce and industry are the best mines of a nation.
3. Let your heart feel for the afflictions and distresses of every one.
4. To persevere is one's duty, and to be silent is the best answer to calumny.
5. I never wish to promise more than I have a moral certainty of performing.
6. Every action in company ought to be with some sign of respect to those present.

7. I shall never attempt to palliate my own foibles by exposing the errors of another.

8. Labor to keep alive in your breast that little spark of celestial fire called conscience.

9. It is a maxim with me not to ask what, under similar circumstances, I would not grant.

10. Ingratitude, I hope, will never constitute a part of my character nor find a place in my bosom.

11. Be courteous to all, but intimate with few; and let these be well tried before you give them your confidence.

12. Associate with men of good quality if you esteem your own reputation, for it is better to be alone than in bad company.

13. A good character is the first essential in a man. It is, therefore, highly important to endeavor not only to be learned, but virtuous.

14. I am resolved that no misrepresentations, falsehoods, or calumny shall make me swerve from what I conceive to be the strict line of duty.

15. Without virtue and without integrity, the finest talents and the most brilliant accomplishments can never gain the respect and conciliate the esteem of the truly valuable part of mankind.

16. The consideration that human happiness and moral duty are inseparably connected, will always continue to prompt me to promote the progress of the former by inculcating the practice of the latter. EDITOR.

608. Has Alaska a territorial government?

Ans.—Yes, partially. A bill passed Congress in May, 1884, giving Alaska the following civil officers to be appointed by the President: Governor, Judge, District Attorney, Marshal, Clerk, and Four Commissioners. Sitka is the seat of government, and the laws of Oregon are taken as the code, so far as they are applicable to the territory. The four commissioners are to reside at Sitka, Wrangell, Juneau, Unalaska, respectively. Each is allowed to appoint a deputy marshal. A district court meets at Sitka in May and at Wrangell in November. No legislature nor representative in Congress; U. S. land laws not in force; no intoxicating liquors allowed; provisions for education.

Alaska contains about one-sixth of the area of the U. S., and its mountains are the highest. Its coast-line, if extended, would circumscribe the globe. It furnishes nearly all the seal skins for the world, and exports fish, minerals and petroleum. Thousands of square miles in the southeastern part are covered with yellow cedar, white spruce, hemlock and balsam fir, which will be the great reserve lumber region of the U. S. The temperature ranges from 90° above zero in summer to 75° below in winter. The population consists mostly of natives, about 30,000, but about 2,000 whites are there who engage in mining and trading. EDITOR.

609. Why red and white stripes on the U. S. flag? What do these colors signify?

Ans.—It was formed by combining the red flag of the army and the white one of the navy previously in use. The colors signify as follows: red, war; white, peace. J. W. CORBIN.

610. What city deserves to be called the Lyons of America, and why?

Ans.—Newark, N. J., on account of its silk manufactures. J. W. CORBIN.

611. Can problems, giving rise to affected quadratic equations, be solved by Arithmetical Analysis? Id.

Ans.—Some algebraic problems may be solved by Alligation and also by "Sliding Fellowship." J. W. CORBIN.

612. Referring to 365 and 439. 1. Name and locate the gland that secretes "this air." 2. How do those fishes whose air-bladders are divided by partitions rise in water? 3. How do those fishes rise, whose air-bladder is closed? 4. Would not secretion so rapid as to be able to account for the sudden rise of a fish, be anomalous in physiology? 5. Is there not a better explanation of the functions of the swim-bladder than that which requires the "expelling" of the air?

E. S. LEWIS.

Ans.—(1) In fresh-water fishes the gas in the air-bladder consists of nitrogen, with about 10% oxygen. In sea-fishes oxygen predominates, as much as 87% having been found. This gas is secreted from the inner surface of that characteristic organ, and must come from the blood. In all fishes, the air-bladder receives arterial blood from the system of the aorta, and returns venous blood to the portal or vertebral veins. It is, therefore, not unlikely that an exchange of gases between the two kinds of blood takes place by means of the *retia mirabilia* in many bladders. This organ may be single, or divided by a partition, one division lying behind the other. Its inner surface is found in some fishes perfectly smooth, while in others it forms manifold pouches and cells.

(2) When two divisions occur, the anterior one has a middle elastic membrane, not found in the other. The posterior division is provided with a pneumatic duct or membranous bronchus entering the ventral side of the œsophagus, at the entrance of which is a glottis. In some this duct enters the dorsal side of the intestinal canal, or the cardiac portion of the stomach. Each division is supplied with a muscular layer, by which it can be separately compressed, so that part of the contents of the one may be driven into the other. This enables the fish to raise or depress the front part of the body *ad libitum*. In some fishes the anterior portion is strangely connected with the organ of hearing. Some possess an apparatus connected with the skull, by which a voluntary compression of the air-bladder, expels the air through the duct. The air-bladder of others possesses still further the characteristics of a lung and assumes its functions.

(3) In the early stages of development all air bladders are provided with a duct, but as the muscular layer for the compression of that organ strengthens, the duct is more or less obliterated, and the rising and sinking may be accomplished by muscular action upon the air-bladder.

(4) It is not necessarily so. This secretion may be regulated by the fish in a manner not yet understood by man.

(5) Its special function is to change the center of gravity, or the specific gravity of the fish, and in a general sense, its function is a mechanical one.—See *Britannica*, article *Ichthyology*.

EDITOR.

614. What officer lost his life because he neglected to open a note?

Ans.—Col. Rahl. A note was sent by a tory giving him warning of the approach of the American forces but being excited by wine and the play he thrust it unopened into his pocket.

ED. RYNEARSON.

615. Who first noticed the Gulf Stream?

Id.

Ans.—It was first noticed by Aláminos, April 2. 1512, pilot of De Leon's expedition, who described it in a journal of the voyage.

C. A. SEHBRING.

616. What minister, who was chaplain of a New Jersey regiment during the Revolution, when the wadding of his regiment gave out, mounted his horse, rode to a church near by, and returned with an armful of Dr. Watts' hymn-books, which he distributed among the troops, with the pious injunction, "Now put Watts into them, boys!?" Give incident.

JOHN H. KNIESLY.

ANS. Rev. James Caldwell, whose wife had been brutally shot a fortnight before by British soldiers, brought hymn books out of a Presbyterian church for wadding when everything else had failed, and exclaimed, "Now, boys, put Watts into them." The British force numbered five thousand. The British commander was Gen. Knyphausen, that of the Americans, Gen. Greene.

ED. RYNEARSON.

617. Who was Louis Kossuth, and for what purpose did he visit America? Id.

ANS.—Louis Kossuth, born at Monok, April 27, 1802, a great Hungarian patriot, came as a guest of the American people in 1851, and was received with such honor as is given to very few. He spoke in behalf of European liberty in all the larger cities of our land, and raised sums of money in behalf of his own people. He remained in the U. S. about eight months. His course through the land was one continued ovation. He is still living at his home in Turin, and enjoys good health.

ED. RECK.

618. What gun was called the "Peacemaker," and what two noted men were killed by its explosion? Id.

ANS.—The Peacemaker, was a large cannon which was being tried on board the U. S. steamship Princeton, lying in the Potomac River; it exploded, killing Sec'y of State, Abel P. Upshur, and the Sec'y of the Navy, Thomas U. Gilmer.

CHAS. MANN.

619. Give a sketch of Louise Michel, and tell where she is now.

ANS.—She is an unmarried lady of some forty years of age, extremely romantic, and at one time a successful and happy schoolmistress upon the heights of Montmartre, where she owned a nice little home and a school building. In the Franco-Prussian war the government took her home for war purposes, being required in connection with the defense of Paris. She was paid only a small part of its value. This circumstance in connection with the shooting of her lover, a soldier in the commune insurrection, by one of the Government troops, excited her indignation, and she became the unrelenting foe of the Government. She was the leading spirit among the women who threw petroleum on the public buildings of Paris and did all in their power to destroy that city by fire. Having also fought at the barricades in aid of the commune she was taken to the French penal colony (New Caledonia), whence she returned a few years ago, having been amnestied by the Government. She associated herself with the Socialists, and was in complete sympathy with the Nihilists of Russia. She is now in prison at Paris, and refuses to accept a pardon, unless as a part of general amnesty to all political prisoners. She is the author of some fine French poems, and has written much for her journal—*La Revolution Sociale*. She has written a book in prison, which has lately been published, containing legends and songs of an Indian tribe. Its title is *Legendes et Chantes de Gesie des Canaques*. She caused many sensations in her lifetime by her bold and impulsive nature. She claims equal rights with man, and says in France a married woman was a slave, and as "she taught school under the reign of Napoleon III., she would not increase the slaves of the empire."

EDITOR.

CREDITS.

GEO. L. SHANER, *Stewart's Station, Pa.*, 603.

S. S. MILLER, *Bradford, O.*, 604.

J. W. CORBIN, *Pine Bluff, Ark.*, 605, 608, 617.

C. A. SEERING, *N. Star, O.*, 605, 617.

VIOLA KENDRICK, *De Witt, Mo.*, 605.

ED. RECK, *Gettysburg, Ohio*, 605, 615, 618.

CHAS. MANN, " " 605, 615, 616.

ED. RYNEARSON, " " 605, 608, 615.

G. H. HARVILL, *Ada, La.*, 604.

JNO. KNIESLY, *Horatio, Ohio*, 605.

QUERIES.

646. Give an explanation of the magnetic meridian, with hints for surveying old lines, etc. J. W. DEBERY.

647. When and by whom was the plan upon which the Centennial was conducted, originated? JOHN KNIESLY.

648. In what year were Post Offices first established? S. S. M.

649. Why is the earth's orbit elliptical? S. A. SMITH.

650. Where is the "Gate of Tears"? What was known as the "Scourge of the Ocean"; also the "Kitchen Cabinet"? CHAS. BIGLER.

651. What caused the decrease in population on the Sandwich Islands from 400,000, when Capt. Cook discovered, to 60,000 at present? W. I. DITMER.

652. Where is the center of gravity in a floating body? BUB.

653. Whence came the diamonds and precious stones now "lying loose" and a nuisance in the U. S. treasury? LEWIS BROWN.

654. Note all the late geographical changes in the government boundaries, capitals, etc., of the various countries in which our textbooks are not correct at present? ID.

655. Give the origin of the words "Yankee", "Hurrah", "Fools Cap", "Hobson's Choice". A. N. SYMMES.

656. Give the author of the words: "The republic has no need of savants?" What circumstance called forth the statement? WM. TAIT.

657. Describe vulcanized Rubber? By whom was India Rubber made known? G. L. S.

658. What president did not belong to a secret society? Does Cleveland belong to any secret society? B. F. F.

659. Locate Aullagus, Aruba, Almagro, and tell what they are. J. E. D.

660. What were the Caroline Books? M. T. PATE.

661. Why does the moon rise about fifty minutes later every night? D. C. L.

662. What statue is reported to sing at sunrise? ID.

663. What is the "Riddle of the Sphinx" and what the answer? ID.

664. How is noon at different cities indicated by a "ball" arrangement at the Observatory, Washington, D. C.? ID.

665. Give the origin and meaning of the term *mugwumps* as used in political parlance. N. A. G.

666. Give the boundaries of the different oceans, where they form one common body of water. ID.

667. Describe the largest telescope in the world. ID.

668. Please explain what is meant by a printer's "square" in measuring advertising matter. UNO.

NOTE.—Answers should reach us by July 5. No date was fixed last month, so we shall wait for answers till the 15th of this month.



EDITED BY

JOHN S. ROYER.

VOL. VI.

JULY, 1885.

No. 7.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

731. *By L. A. REED, Cleveland, Ohio.*—Two men and a boy engaged to dig a field of potatoes for \$10. The boy could pull the vines as fast as the two men could dig the potatoes, but either of the men could pull the vines $\frac{1}{3}$ faster than the other man and boy could dig them; how must they share the money?

By A. L. FOOTE, Hempstead, Long Island.

Let x = value of pulling vines and y = value of digging potatoes. Then $x + y = 10 \dots (1)$. Since the two men dig the field while the boy pulls the vines, then one man digs $\frac{1}{2}y$ while the other man and boy do $x + \frac{1}{2}y$; and again, one man does $\frac{4}{3}x$ while the other man and boy do y . What they do in a certain time in the one case is proportional to what they do in the same time in the other case; hence

$$\frac{1}{2}y : x + \frac{1}{2}y :: \frac{4}{3}x : y, \text{ or } y^2 - \frac{4}{3}xy = \frac{8}{3}x^2;$$

whence $y = \frac{2}{3}x(1 + \sqrt{7})$. Substituting this value of y in (1), we have $x + \frac{2}{3}x(1 + \sqrt{7}) = 10$, $x = 30 \div (5 + 2\sqrt{7}) = \$2.915+$, the boy's part; $(10 - 2.915) \div 2 = \$3.5425+$, each man's part.

By W. T. MOONEY, St. Mary's, Ohio.

Let x = what the boy can dig in a certain time, a = what one man can dig, $2a$ = number of vines the boy can pull, and $1\frac{1}{3}(x + a)$ = the number a man can pull, all in the same time. Then

$$x : a :: 2a : 1\frac{1}{3}(x + a), \text{ whence } x^2 + ax = 1\frac{1}{3}a^2.$$

Completing the square and extracting square root, we have $x + \frac{1}{2}a = \frac{1}{2}a\sqrt{7}$, whence $x = .82287a$. The money must be divided into $1 + 1 = .82287 = 2.8227$ parts. Each man gets one part or \$3.54, and the boy gets .82287 parts, or \$2.92.

W. L. Harvey gave three excellent solutions of this interesting problem, but his algebraic equations required two-line composition, which is avoided in the above. It was also well solved by J. C. Gregg and J. C. Roebuck.

732. By A. L. FOOTE, *Hempstead, Long Island*.—A set out from C towards D and traveled 7 miles an hour. After he had gone 32 miles, B set out from D towards C, and went each hour $\frac{1}{2}$ of the whole distance; and after he had traveled as many hours as he went miles an hour, he met A. Required the distance between the two places.

By CHARLES M. SMITH, *Byron Center, N. Y.*

Let x = B's rate per hour and also the number of hours he travels to meet A; now $19x$ = distance from C to D, and $x(7+x)$ = distance both traveled after B set out. Then

$$x^2 + 7x + 32 = 19x, \text{ or } x^2 - 12x = -32.$$

Whence $x=8$ or 4 , and $19x=152$ or 76 miles, the required distance.

Messrs. Gregg, Wiley, Leahy, Drummond, Sublette, Mooney, Roebuck, Haun and the Proposer furnished good solutions.

733. By T. L. BREWER, *Mt. Heron, Ohio*.—A piece of elm weighs 15 lbs. in open air. A piece of copper, which weighs 18 lbs. in air and 16 lbs. in water, is attached to it, and the compound weighs 6 lbs. in water. What is the specific gravity of the elm?

By JOHN C. GREGG, A. M., *Brazil, Ind.*

A volume of water equal to the volume of copper, weighs 2 lbs.; a volume of water equal to the bulk of the compound weighs 27 lbs. Hence a volume of water equal to the bulk of the elm, weighs 25 lbs., and the specific gravity of the elm is $15 \div 25 = .6$.

Solved by A. L. Foote, Chas. M. Smith, M. T. Mooney, T. L. Brewer, Wm. Wiley, G. W. Leahy, J. C. Roebuck and Fred. Stauffer.

734. By W. L. HARVEY, *Maxfield, Me.*—It is required to divide the base of an obtuse angle triangle into two parts, so that a line from the obtuse angle will be a mean proportional between the segments.

By A. L. FOOTE, *Hempstead, Long Island*.

Let ABC be the triangle, obtuse-angled at C . Circumscribe it by a circle, and from C through the center O draw the diameter CD . On OC as a diameter, describe the circle $CGOE$, and through E and G draw the chords CEF and CGH . The chord CF will be bisected at E for by similar triangles we have $CO : OD :: CE : EF$. But since $CO=OD$, we have $CE=EF$, and from the properties of intersecting chords in a circle, we get $AE \times EB = CE \times EF$. But since $CE=EF$, it is $AE \times EB = CE^2$; or $AE : CE :: CE : EB$. Hence CE is a mean proportional between the segments AE and EB . In like manner it may be proved that CG is a mean proportional between the segments BG and AG .

Good demonstrations were given by Wm. Wiley, Gordon Dinsmoor and the Proposer.

735. By GEO. L. SHANER, *Stewart's Station, Pa.*—The interest of the sum of $\frac{1}{2}$ of A's fortune, $\frac{2}{3}$ of B's, and $\frac{3}{4}$ of C's fortune, for a certain time, at $2\frac{1}{2}\%$, was to this sum as 9 to 209; and the amount of this interest for $6\frac{3}{4}$ times as long, at 5 times as great a per cent., was \$945. What was the fortune of each, provided A's fortune was to B's as 1 to 3, and B's to C's as 9 to 4, and how long was the first on interest?

By G. W. LEAHY, *Marshallville, Ohio.*

Evidently $\frac{9}{209}$ of the principal equals the interest, and at $2\frac{1}{2}\%$ for one year $\frac{5}{209}$ of the principal equals the interest, hence the time is $1\frac{4}{5}$ years. The amount of \$1 for $1\frac{4}{5} \times 6\frac{3}{4}$, or 12 years at $2\frac{1}{2} \times 5$, or $12\frac{1}{2}\%$ is \$2.50; $\therefore \$945 \div 2.50 = \378 , the interest on $\frac{1}{2}$ of A's, $\frac{2}{3}$ of B's and $\frac{3}{4}$ of C's fortune, which is, by the first condition, $\frac{9}{209}$ of the principal hence $378 \div \frac{9}{209} = \8400 . Now if one part represents A's fortune, then 3 parts equals B's and $1\frac{1}{3}$ parts is C's, and we have $\frac{1}{2}$ of a part plus $\frac{2}{3}$ of 3 parts plus $\frac{3}{4}$ of $1\frac{1}{3}$ parts, equal \$8400; or $3\frac{1}{2}$ parts = \$8400 and one part = \$2400, A's fortune, B's = \$7200 and C's \$3200.

S. S. Miller gave a full solution of this mental arithmetic problem. G. H. Harvill and Fred. Stauffer gave similar solutions. Solved algebraically by Messrs. Foote, Sublette, Smith, Wiley and Drummond.

736. By IRA S. WOLCOTT, *Litkens, Pa.*—Find two numbers such that the difference of their squares shall be a cube and the difference of their cubes a square number.

By the HON. JOSIAH H. DRUMMOND, *Portland, Me.*

We have $x^2 - y^2 = m^3 \dots (1)$ and $x^3 - y^3 = \square \dots (2)$. Now (1) gives $x^2 = y^2 + m^3$ (say) $y^2 + 2mny + m^2n^2$, and we have $y = (m^2 - mn^2) \div 2n$. Take $m = 4q^2n$, then

$$y = 8q^4n - 2q^2n^2 = 2q^2n(4q^2 - n) \dots (3),$$

and

$$x = y + mn = 2q^2n(4q^2 + n) \dots (4).$$

Substituting these values in (2), we have

$$(2q^2n)^3[(4q^2 + n)^3 - (4q^2 - n)^3] = \square \dots (5).$$

Dropping the squares and reducing, we have

$$48q^4 + n^2 = \square = (\text{say}) n^2 + 2pq^2n + pq^4, \text{ from which} \\ n = [q^2(48 - p^2)] \div 2p \dots (6).$$

In (6) n must be less than $4q^2$, or one of the numbers will be negative. Taking $p = 6$, we have $n = q^2$, and from (3) and (4), $x = 10q^4$ and $y = 6q^4$, where q may be any number. This gives an infinite number of integral results, but of course by taking $p =$ any number between 4 and the $\sqrt{48}$ exclusive, we may have an infinite number of infinite series of results, which, however, will be fractional.

Our popular and learned friend solved this problem while traveling on the cars, and made three solutions. The above is the last effort and we consider it a valuable production. A. L. Foote and J. C. Roebuck sent solutions that are elegantly and skillfully made.

737. By J. C. COBBIN, *Pine Bluff, Ark.*—To plant nineteen trees so that they shall constitute nine straight rows with five trees in each row.—*Welch's Geometry.*

By J. M. TAYLOR, *Weston, Oreg.*

Draw a circle and divide the circumference into six equal arcs, each being equal to the radius. Join the alternate points thus determined, making a six-point star. The three diagonals of this star, each drawn through the center of the circle, together with the lines drawn before, will constitute the "nine straight rows," with five trees in a row by setting one at each intersection of two lines, one at each point of the star and one at the center of the circle.

S. G. CAGWIN, *New London, N. Y.*

Draw an equilateral triangle; in this draw another equilateral triangle with its sides parallel to the first, and passing about midway between the common center of the triangles and the middle of the sides of the first. Now produce the sides of the inner triangle till they meet the sides of the first triangle. Draw a line from each angle of the first triangle to the middle of the opposite sides. Set a tree at every intersection of two or more lines and the thing is done.

Chas. M. Smith, John H. Kniesly, W. G. Russell, jr., A. L. Foote, J. C. Roebuck, J. W. Jones, T. L. Brewer, G. W. Leahy and the Proposer also solved it. J. K. P. Saylor furnished two solutions.

738. By W. B. ANDERSON, Pres. Western Academy, *La Belle, Mo.*—A man bought a farm for \$6000, and agreed to pay principal and interest in three equal annual installments. What was the annual payment, interest being 6%?

By J. K. P. SAYLER, *Romeo, Tenn.*

Let $a = \$6000$; $r = .06$; payment $= x$. Then by the well-known formula $x = \frac{ar(1+r)^3}{(1+r)^3 - 1} = \frac{6000 \times .06 \times 1.191016}{1.191016 - 1} = \$2244.658 +$.

By W. L. HARVEY, *Maxfield, Me.*

The portion of the principal to be paid each year must be such, that the first payment at compound interest for 3 years, the second for 2 years, and the third for 1 year, will be equal. These payments will be proportional to the present worth of \$1.00 due respectively in 3, 2, 1 year. The sum of these proportional quantities,

$$\frac{1}{(1.06)^3} + \frac{1}{(1.06)^2} + \frac{1}{1.06} = \frac{(1.06)^3 - 1}{.06(1.06)^3} = \$2.673 +.$$

Hence $\$2.673 : \$1 :: \$6000 : \2244.66 .

By D. S. POND, Rochester, Ohio.

The \$6000 at compound interest for 3 yrs. equal \$7146.096. Then $\$1.00 + \$1.06 + 1.1236 = 3.1836$, and $7146.096 \div 3.1836 = \$2244.6588$.

Also solved by Messrs. Corbin, Roebuck, Jones, Foote, Leisy, Stauffer, Reed, Mooney, Smith, Wiley, Rynearson, Young, and Miss Ella C. Lahiff.

739. *By ED. RYNEARSON, Gettysburg, Ohio.*—A speculator invests \$2120 in grain, including 4% for freight and 20% for commission; then sells the grain at 20% advance on the cost price for a note at 60 days, which he gets discounted at bank at 6%, and repeats this operation every 10 days; how much will his gains amount to in a month, if he invests the whole proceeds each time?

By A. L. FOOTE, Hempstead, Long Island.

The amount paid for grain is $\frac{100}{96} \times 2120 = \2000 ; the grain sells for $\frac{120}{100} \times 2000 = \2400 . The discount on this for 63 days at 6% is \$25.20. The net proceeds of first investment = \$2374.80; second in like manner = \$2660.22 $\frac{108}{105}$; third in like manner = \$2979.95 $\frac{20}{100} \frac{20}{100} \frac{20}{100}$, and the gain required is $2979.95 \frac{20}{100} \frac{20}{100} \frac{20}{100} - 2120 = \$859.95 \frac{20}{100} \frac{20}{100} \frac{20}{100}$.

Chas. M. Smith also furnished a solution.

740. *By A. F. PARSONS, Arroyo Grande, Cal.*—A square field has a road $82\frac{1}{2}$ feet wide running through it. The road enters the field 10 rods from one (N. E.) corner and leaves it 15 rods from the S. W. corner on the opposite side. The area of the field exclusive of road is 40 acres. Required the side of field.

By WM. WILEY, Detroit, Mich.

The road is 5 rods wide. Let x = No. of rods in side of field and let y = all of the base except 25 rods and the length occupied on the base by the road; 40 acres = 6400 rods = a . Then

$$x^2 - a = 5\sqrt{(x^2 + y^2)} \dots (1), \text{ and } 25x + xy = a.$$

Whence $y = (a \div x) - 25 \dots (2)$ and $x = a \div (25 + y) \dots (3)$. Substituting this value of x in (1), squaring and restoring the value of a ,

$$y^4 + 100y^3 - 9100y^2 - 618705y = -33335000,$$

where $y = 52.10281$, and from (3) $x = 83.006$. But it is easier to obtain the result by trial. Assume $x = 83$; find y by (2) and then in (1) we find the assumed value to be very nearly correct and another trial gives $x = 83.006$ rods.

By H. GUNDER, New Castle, Ind.

Let x = side of field in rods, and y = width of road parallel to side. Then $x(x - y) = 6400 \dots (1)$. Since the road is 5 rods wide, by similar triangles,

$$x^2 + (x - y - 25)^2 : y^2 :: x^2 : 25, \text{ or}$$

$$25x^2 + 25(x - y - 25)^2 = x^2y^2 \dots (2).$$

From (1) $x^2y^2 = (6400 - x^2)^2$, and $x - y = 6400 \div x$. Putting these in

(2) we get $25x^2 + 25(6400 \div x - 25)^2 = (x^2 - 6400)^2 \dots (3)$; (3) when expanded gives a 6th degree equation of which one root is $x = 83.006$, which is the length of a side of the field.

Solutions were received from A. L. Foote, R. A. Leisy and W. L. Harvey.

741. By ROBT. J. TOTTEN, *New Wilmington, Pa.*—Find the circumference of a circle in which a regular decagon, side 10 inches, may be (1) inscribed, (2) circumscribed.

By L. A. REED, *Cleveland, Ohio.*

If radii be drawn from center of circle to each angle of decagon, the decagon will be divided into ten equal triangles. Draw a perpendicular to side of decagon from opposite angle; this perpendicular is the radius of inscribed circle; then will tangent $18^\circ = 5 \div \text{radius of inscribed circle}$, or radius of inscribed circle $= 5 \div \tan 18^\circ = 5 \div .324920 = 15.389+$, and circumference $= 96.69$ in., and $\sin 18^\circ = 5 \div \text{radius of circumscribed circle}$, or radius of circumscribed circle $= 5 \div \sin 18^\circ = 5 \div .30902 = 16.18+$, and circumference $= 101.66$ in.

Also solved by Messrs. Mooney, Oliver, Foote, Pond, Wiley and Drummond.

742. By HON. JOSIAH H. DRUMMOND, *Portland, Me.*—In a right-angled triangle whose base is 1 and whose perpendicular is $\frac{3}{4}$, inscribe a square one side of which lies upon the base, and one on the perpendicular; then in the remaining triangle, inscribe a square one side of which lies on the base, and so on *ad infinitum*. Required the total area of the series of inscribed squares.

By J. W. PFEIFFER, *Bolivar, Ohio.*

Let ABC = the triangle; $AB = 1$, and $AC = \frac{3}{4}$; also a, b, c , etc., be the sides of the squares. By similar triangles, we have the proportion $a : \frac{3}{4} - a : : 1 - a : a$; whence $a = \frac{3}{7}$. Also $b : \frac{3}{7} - b : : \frac{4}{7} - b : b$; whence $b = \frac{1}{4}\frac{3}{9}$. We now see that the sides of the squares form a geometrical progression of which the first term is $\frac{3}{7}$, and common ratio $\frac{4}{7}$. The areas of the squares are $\frac{9}{49}$, $\frac{1}{2}\frac{4}{9}\frac{1}{1}$, etc. The common ratio of this progression $= \frac{1}{4}\frac{16}{9}$; hence $\frac{9}{49} \div (1 - \frac{1}{4}\frac{16}{9}) = \frac{9}{49} \times \frac{4}{3} = \frac{3}{11}$ = area of squares to *ad infinitum*.

By J. C. ROEBUCK, *Rock Falls, Iowa.*

Let $a = \frac{3}{4}$, the perpendicular and $b = 1$, the base; then side of first inscribed square is

$$\frac{ab}{a+b}; \quad a - \frac{ab}{a+b} = \frac{a^2}{a+b},$$

the perpendicular of triangle above inscribed square, and the ratio of square to this triangle is as $b : \frac{1}{2}a$, and so on *ad infinitum*. Hence the sum of the areas of inscribed squares is

$$\frac{1}{2}ab \div (b + \frac{1}{2}b)b = \frac{ab}{a+2b} = \frac{3}{4} \div 2\frac{2}{4} = \frac{3}{11}.$$

Solved by Chas. M. Smith, Wm. Wiley, W. T. Mooney, W. L. Harvey, L. A. Reed, Henry Gunder, R. A. Leisy, F. P. Stauffer and the Proposer.

743. *By* W. L. HARVEY, *Maxfield, Me.*—Charles Garland carried to market a hog weighing 200 lbs., also one for John Day weighing 300 lbs., and sold the two hogs for \$30. The butcher decided that John Day's hog was worth 1 cent per lb. more than Charles Garland's. How much should each receive for his hog?

By J. C. CORBIN, *Little Rock, Ark.*

Day's extra cent per pound entitles him to \$3; $30-3=\$27$, $\frac{2}{3}$ of which is Garland's, and $\frac{1}{3}$ Day's. Garland's share is $\frac{2}{3}$ of $27=\$10.80$, and Day's share is $\frac{1}{3}$ of $27+3=\$19.20$.

Similarly solved by Messrs. Drummond, Rynearson, Mooney, Reed, Harvey, Pfeiffer, and Pond. Algebraically by Messrs. Stauffer, Leisy, Roebuck, Oliver, Saylor, Wiley, Smith and Foote.

744. *By* G. H. HARVILL, *Ada, La.*—There are p arithmetical progressions beginning with 1, and the common differences are 1, 2, 3, etc., to p ; prove that the sum of their n th terms $=\frac{1}{2}[(n-1)p^2+(n+1)p]$.

By CHARLES M. SMITH, *Byron Center, N. Y.*

Finding the n th term of each of these progressions in their order, by the formula, $l=a+(n-1)d$, we get n , $2n-1$, $3n-2$, ..., $pn-p+1$. These n th terms form an arithmetical series, consisting of p terms, whose first term is n , and whose common difference is $n-1$. Obtaining the sum of these terms by the formula, $S=\frac{1}{2}n(a+l)$, we get $S=\frac{1}{2}p(n+pn-p+1)=\frac{1}{2}[(n-1)p^2+(n+1)p]$.

Messrs. Reed, Gunder, Wiley, Drummond, Foote, Mooney and the Proposer gave excellent solutions. We correct the misprint in problem.

710. *By* DR. N. R. OLIVER.

A, B and C meeting once betimes, and it being noon they did agree,
The two who had the fewest dimes should have their dinner free
And the one who had dimes the most, should for their dinners pay the host.
Now, when they counted it was found that B had twice as many dimes
As A, which made him look profound and count them over three times;
And, B comparing his with C, found C had twice as many as he.
Then C for their dinners had to pay, which was 20 dimes for three,
And said he would do it every day, till their dimes should even be,
When all theirs then, when put together, would buy 3 eagles of no feather.
Now tell me all who can and try, how many eagles would all this money buy.

By L. A. REED, *75 Woodland Court, Cleveland, Ohio.*

Let x = No. of dimes A had, $2x$ = B's number and $4x$ = C's number, and put m = No. of meals taken. Then $7x-20m=300$ dimes. Now m must be some even number, and it is required to find a number which can be divided by 7 and at the same time be an even number of times 20 dimes. Six times 20 dimes will do this, and if $m=6$, $x=60$. Hence A had 60 dimes, B, 120, and C, 240. They could buy four eagles and have 20 dimes left for cigars.

D. S. Pond takes two views of the conditions, and gives $4\frac{2}{10}$ and 7 eagles as results. J. C. Roebuck also solved it.

Is π a Circulating Decimal?

By MARCELLUS M. THOMPSON, *Clarksburg, W. Va.*

Every interminate decimal does not circulate, or else the Celebrated Problem of Squaring the Circle, having for its object the finding of a line, the square on which will be equivalent to the area of a circle of a given diameter, could be solved, the ratio between the area of a circle and the square of its radius being a circulating decimal. The value of π , 3.14159, etc., adopted by mathematicians does not arise from the transformation of a common fraction, for more than two thousand years ago Archimedes in his work, *De Dimensione Circuli*, ascertained that π was nearly in the proportion of 7 to 22, which was afterwards increased, 113 to 355. Mr. Robinson, well said: "The approximation is so close that the exact solution is no longer a question of practical importance," however undetermined. Van Ceulen, the author of *De Circulo et Adscriptis*, first computed the result correct to thirty-six decimal places, by a tedious mechanical process of subdividing the arcs of the circle. According to Mr. Bonnycastle, 3.141592653589793238462643383279502884....., the circumference of the circle when the diameter is unity, was cut on his tomb stone in St. Peter's church-yard at Leyden. By means of an infinite series in the differential and integral calculus, π has been ascertained true to two hundred and fifty-three places, without termination, or becoming a repeating decimal. It is a question whether π is a circulating decimal, which, if proven, solves one of the most interesting and wonderful problems in mathematical science. It is generally conceded that π is an interminate decimal. Mr. Ray very ingenuously fails to bridge the chasm, however without referring to the proposition, when he said, "every interminate decimal, arising from the transformation of a common fraction will be found, if the division be carried far enough to contain the same figure, or set of figures, repeated in the same order without end." We consequently inquire, does it necessarily follow, that an interminate decimal, not arising from a transformed common fraction, is not circulating. If the affirmative of this proposition be established, the perplexing and intricate problem of squaring the circle, may yet be elucidated, by proper effort, and a thorough understanding of Fluxions and the Calculus.

ERRATA.—May No., page 82, 6th line from bottom, read $d' + m$ for $d + m$; and p. 83, 5th line from top, read 10×100 for $10 + 100$.

Problems for Solution.

757. *By* ROBT. J. TOTEN, *New Wilmington, Pa.*—Two towers, AB and CD , of different height, are perpendicular to a horizontal plane. It is required to find the heights of the towers and the distance between them if the line from the top of the higher, AB , to the bottom of the lower be 100 ft., the line from the top of the lower to the bottom of the higher, 80 ft., and their point of intersection be 20 feet from the ground.

758. *By* G. H. HARVILL, *Ada, La.*—Required the length of the diagonal of a cube, the length of whose side is s .

759. *By* C. T. YOUNG, *Weaversville, Pa.*—A broker sold 6% stock at 105, and invested the net proceeds for the owner in another 6% stock at 103, brokerage $\frac{1}{2}\%$ on each transaction; what rate does the investment pay?

760. *By* C. T. YOUNG.— O is a fixed point from which any straight line is drawn meeting the circumference of a fixed circle at P ; in OP a point Q is taken such that OQ is to OP in a fixed ratio. Determine the locus of Q .

761. *By* B. F. FINKEL, *Ada, Ohio.*—A field in the form of a right triangle has a tree in it; the nearest distance from the tree to the fences are 8, 10 and 12 rods respectively. Determine the area of field.

762. *By* N. R. OLIVER, *Dorchester, Ontario.*—Given the quadrant of a circle containing an acre of land; required the length of a line perpendicular to the side and terminating in the curve that will divide it into two equal parts, without the application of Algebra?

763. *By* L. A. REED, *Cleveland, Ohio.*—A cubical block of wood just sinks into the water half-way and supports a weight of n pounds. If this block be divided into m boards, each of equal thickness, what will be the total amount supported by all these boards, when each just sinks half-way into the water?

764. *By Request.*—Two pendulums make 24 beats in 26" and 36 beats in 40", respectively; if they start together, when first will the beats occur together?

765. *By* LIBRA.—A New York merchant, having £350 to pay in London, bought a draft for that amount with gold at 114, exchange standing at \$4.85. He might instead have remitted 5-20's, then selling at $119\frac{1}{2}$ in New York, and worth $107\frac{3}{4}$ in London. Would he have gained or lost by so doing, and how much?

766. *By* LIBRA.—A merchant bought 56 bu. of wheat and sold $\frac{1}{3}$ of it at a profit of 5%, $\frac{1}{4}$ of it at a profit of 7%, and the remainder at a profit of 12%. Had he sold all at a profit of 9%, his gain would have been \$24.50 less; what did the wheat cost him per bu?

767. *By* A. H. STANHOPE, *North Bradford, Me.*—A lady has two silver cups, and but one cover for both; the cover weighs 10 ounces; now, if the cover be put on the first cup, it will make the weight double that of the second, and if the cover be put on the second, it will make the weight triple that of the first; what is the weight of each?—*Greenleaf.*

768. *By* D. H. DAVISON, *Minonk, Ill.*—After placing four balls of equal size in a compact triangular pile, one of the base balls rolled from the other two, resting equidistant from each, being 2 inches distant from their point of contact; the top ball resting on the three base balls, being 3 inches above the plane on which they rested. Required height of the pile in last-mentioned position.

769. *By* A. W. MASON, *Cedar Falls, Iowa.*—A hemispherical bowl ACB contains a weight W which is attached to a weight P by means of a string passing over the rim of the bowl at the point A . Determine W 's position of equilibrium.

Solutions should be received on or before Aug. 6.

Editorial Notes.

This issue enters the mail on the first day of July, and will reach our friends in time, who desire to go to Chautauqua.

We returned June 18 from a very pleasant visit to Union Co., Pa., where the first nineteen years of our life were spent. With improved health we have again entered upon the work before us, hoping our friends will not relax their efforts in behalf of the *Visitor* during the hot weather.

Marcus Baker of the U. S. Coast Survey Office, Washington, D. C., has lately commenced a summer campaign of field work in surveying in New York Harbor. His New York address is *Coast and Geodetic Survey Office, Old Produce Exchange*. Your attention is invited to his answer to query 504 in this issue, as it corrects a prevailing erroneous idea relative to the American inch.

The index to Vols. IV. and V. will soon be ready and will be sent free to all subscribers, before the first of September. It will include the title page. Said volumes should then be bound together, making a valuable book of about five hundred pages octavo size. The production of this index is attended with considerable expense, but its value will be appreciated by all. Hereafter we shall issue an index and title page with the last number of each year.

One of the most important queries to be answered in August, is No. 654, p. 112 of last issue. We earnestly solicit answers either partial or complete. It is desirable that the principal changes in the last three years should be carefully noted. In teaching geography and history, the instructor should give marked attention to current events and the changes they produce. We further solicit answers to query 636, as the question is said to have been propounded at a teachers' examination. We know nothing of Darius Tucker. Wonder if he is any relation to Dan Tucker. Let our friends make diligent inquiry and report.

The *Visitor* is still receiving additional subscribers through the efforts of its friends. We are under obligations to the following persons for esteemed favors in soliciting subscriptions and forwarding the same: C. F. Swisher, of Rockford, W. Va.; P. C. Palmer, Pierce, O.; E. J. Griffis, Ada, O.; C. T. Young, Weaversville, Pa.; A. L. Foote, Hempstead, Long Island; J. W. Ruebush, McGill, O.; Prof. W. B. Anderson, La Belle, Mo.; A. W. Tobias, Graham, Ind.; J. W. Pfeiffer, Strasburg, O.; T. N. Haun, Midway, Tenn., and perhaps others whose names we can not now recall. The season is now here for the live teacher to prepare for his next year's work. There are many persons who would take the *Visitor* at once for its genuine practical features, if they knew of its publication. Tell your friends to send for sample copy, or secure their subscriptions at club rates, and thus aid in the dissemination of practical knowledge.

Hints to Young Teachers.

You have yet two months to mature plans and secure material for your next winter's use. Are you thinking about the matter seriously? Do you know that preparation, patience, perseverance and punctuality form the principal avenues to success? The first topic is the most essential at this time, and permit us to suggest a few thoughts on *preparation* for your work.

Know what books you expect to use, and give them a careful examination. In arithmetic you must give your classes exercises and problems without answers that are not in the book, until the pupil can readily apply the principles he has learned in the text-book. Do this when they get through each rule. Make thorough work, and remember that mental arithmetic or analysis is the magic wand whose touch unfolds the real beauties of calculation. Drill your pupils in oral analysis and teach them to write out neat, concise solutions. The *Visitor* furnishes you many excellent examples from which to select. Let the pupil do his own work; you simply suggest, direct and criticise. Children must be taught to see, to say, to know, and to do.

Language and expression are of untold importance. Commence this culture the first year and continue it to the end of the child's school life. Pure, correct, simple language, in connection with easy, distinct and eloquent expression, is what you should constantly strive to cultivate in your pupils. Introduce sentence-building, the meaning of words used, and have the slates ruled upon which to write these exercises, and their regular reading and spelling lessons. Have the pupils from the primary to the 4th Reader grade do much writing and spelling, with numerous exercises in numbers. During this period the senses are trained to be alert and accurate, good habits and proper thinking are to be established.

The expression of original thought on the part of pupils is worth a hundred times more than merely memorized lessons. This power can be developed by thinking exercises, language lessons, conversation, mental arithmetic, the reproduction in the child's own language of stories read by the teacher, by giving descriptions of countries and narrating incidents of history, etc., etc. Do not try to make scholars by machinery, but rather have the scholarship grow vigorously from the soil of original investigation and deep mental research. Severe criticisms have been passed upon the graded school system as exemplified by some village schools, where it appears the course of study, examinations and promotions were the objective points on the part of the teachers, instead of the proper training and development of the child's mind. Never cram the mind of a pupil with stuff that it can not mentally digest and assimilate. The process produces mental dyspeptics.

You are expected to contribute additional matter to every lesson by way of illustration, to interest and instruct the class. Be not slavishly confined to the text-book, but appear before your class able to conduct the recitation with but little or no reference to the book. Have a full supply of incidents to illustrate lessons in history and geography, and in grammar be able to write out sentences illustrative of the points under consideration.

Have supplementary reading occasionally, say every Friday afternoon. Gather up all the nice, witty little speeches for the younger pupils to say, and drill them to speak well. Invite your patrons to school and call on them frequently to gain their hearty co-operation by making known your plans and wants. You can also ascertain the home training and habits of your pupils, which will aid you in maintaining discipline. Be sure to have good order in your school, for without it your efforts will be fruitless. The secret in school discipline is to keep all busy, and to command the respect and good will of the pupils. Make them feel that your chief aim is to do them good, and then insist on instantaneous obedience.

Examination Questions.

ARITHMETIC.

1. Bought $5\frac{1}{2}$ yds. of cloth at $\$4\frac{1}{8}$ a yd. and paid for it with wheat at $\$1\frac{1}{4}$ per bu.; how many bushels were required?
Ans., 14 bu.
2. Divide 16 ten-millionths by 25 thousandths.
Ans., .000064.
3. A man sold a farm containing a quarter of a section of land, for $\$3280$; what did he receive per acre?
Ans., $\$20.50$.
4. If, at 18 cents per cu. yd., it costs $\$125$ to fill a street 150 ft. long, 50 ft. wide, and $2\frac{1}{2}$ ft. deep, how much will it cost at 19 cents per cu. yd. to fill a street 450 ft. long, 40 ft. wide, and 5 ft. deep?
Ans., $\$633.33\frac{1}{3}$.
5. What principal will amount to $\$8448.752$ in 2 yr. 4 mo. 12 da. at 7%?
Ans., $\$7248$.
6. My agent charged me 3% for selling my wheat and 2% for investing the proceeds in sugar. His bill for commission was $\$250$; what did he receive for the wheat?
Ans., $250 \div .04\frac{1}{2}} = \5100 .
7. If 6 ranks of wood, each 128 ft. long, 3 ft. wide, and 6 ft. high, were piled together in the form of a cube, what would be the height of the pile?
Ans., 24 ft.
8. A man agreed to build 56 rods of fence; for the first rod he was to receive 6 cts., for the second, 10 cts., and so on; what did he receive for the last rod, and how much for the whole?
Ans., $\$2.26$; $\$67.22$.
9. Find the entire surface of a cone whose slant height is 30 in., and radii of bases $1\frac{1}{2}$ and 3 in.

Ans.—Area of upper base is $2\frac{1}{4}\pi$; area of lower base, 9π ; area of curved surface is $\frac{1}{2}(3\pi+6\pi) \times 30 = 135\pi$; hence the entire surface is $2\frac{1}{4}\pi + 9\pi + 135\pi = 146\frac{1}{4}\pi$ or $146.25 \times 3.1416 = 459.459$ sq. in.

10. How many feet in length of pipe whose inner diameter is 3 in. and outer diameter 4 in., can be made of 10 bars of iron 12 ft. long, 3 in. wide and 2 in. thick?

Ans.—The volume of iron is $10 \times 144 \times 3 \times 2 = 8640$ cu. in.; area of one end of pipe is $(4^2 - 3^2) \times .7854 = 5.4978$ sq. in.; hence the length of pipe is $8640 \div 5.4978 \div 12 = 130.96$ ft.

GEOGRAPHY.

1. What is the difference between Physical and Political Geography?
2. What is the greatest number of degrees of latitude a place may have? Of longitude? Where must a place be to have neither latitude nor longitude?
3. Why are the tropics $23\frac{1}{2}^\circ$ from the equator? What would be the width of the zones if the tropics were 31° from the equator?
Ans.—Because the earth's axis is inclined $23\frac{1}{2}^\circ$. North Torrid Zone 31° ; North Frigid 31° ; North Temperate $90^\circ - (31^\circ + 31^\circ) = 28^\circ$. Complement zones the same.
4. Describe a water route from Baltimore, Md., to Pekin, China.
5. Into what waters do the following rivers flow: Danube, Po, Rhine, Obi, Colorado?
6. Name and locate the principal mountains, seas, and rivers of Asia.
7. Name the three largest states, the three most populous states, the one most noted for coal, one most noted for silver.
8. Give the capital of Japan, of Persia, of Hindoostan, of Spain, of Italy.
9. Through what states and near what cities would a line pass drawn due west from Philadelphia?
10. What are trade winds, monsoons, cyclones, icebergs, avalanches, glaciers, sargasso seas.

HISTORY.

1. Name ten tribes of Indians that inhabited America 400 years ago.

Ans.—Montagnais, Chippewas, Miamis, Sacs, Narragansetts, Pequods, Delawares, Shawnees, Seminoles, Chickasaws, etc., etc.

2. What was Law's "Mississippi Scheme"?

Ans.—John Law was a famous Scottish financier, born at Edinburg in 1671. In 1694 he went to London, and being handsome with graceful address, he gained admission into fashionable society, and supported himself by gaming. After killing a man in a duel, he went to the continent and became a notorious gambler. About 1715 he persuaded the Duke of Orleans, Regent of France, to favor a scheme by which he promised to improve very much the financial condition of the Kingdom. In 1716 he obtained a charter for a general bank of issue and discount, under the name of Law & Co. In connection with this bank, he formed, by permission of France, the Western Co. for trade and colonization in the Mississippi Valley, with the exclusive right of the trade between France and Louisiana. He immediately issued paper shares, stocks and bonds in the name of the "Company," which were bought with great avidity by thousands of persons who rushed to Paris during the excitement. Men made fortunes in an hour, money had been loaned at $\frac{1}{4}\%$ for fifteen minutes, and every thing seemed bewitched. But the fall of Law's business fabric was sudden and ruinous in 1720, and he became penniless. He was compelled to leave France and wandered henceforth from place to place as a gambler, and died poor at Venice in 1729. His system is often called the "South-Sea Bubble."

3. Who discovered Labrador? Cuba? Hudson Bay? St. Lawrence River? Pacific Ocean?

Ans.—Labrador by Cabot in 1496; Cuba by Columbus Oct. 28, 1492; Hudson Bay by Henry Hudson in 1610; St. Lawrence River by Cartier in 1535; Pacific Ocean by Balboa, Sept. 29, 1513.

4. Name four Dutch governors of New York.

Ans.—Peter Minuet, 1626; Wouter Van Twiller, 1633; Wm. Kieft, 1838; Peter Stuyvesant 1646.

5. What nation first recognized the U. S. as a republic? When?

Ans.—France in a treaty of alliance and commerce, ratified Feb. 6, 1778.

6. What was the Whisky Insurrection? The Canada Insurrection or "Patriot" War?

Ans.—(1) It was a blaze of opposition among about 16,000 people of western Pennsylvania, against the tax laid by Congress upon distilled spirits in 1791. The insurgents claimed it was unjust for a small portion of country to pay a tax on something not produced elsewhere. Their excessive crops of grain could not be disposed of, save to the distillers, hence the trouble. (2) We presume this alludes to the Canadian struggle for Independence in December, 1837, when Wm. Lyon Mackenzie led his party in arms against the government, but without effect.

7. Give a short history of the Mormons.

8. What points does the Erie canal connect? When was it completed? Who was president at that time?

Ans.—Buffalo and Albany. In 1825. John Quincy Adams.

9. What are the qualifications of the President? Vice President? U. S. Senator? U. S. Representative?

10. Define the following: railroad, steamboat, telegraph, sewing machine, cotton gin.

SPELLING.

Citron, deceit, wrestle, ignite, cylinder, crystallize, rein, cimeter, italicize, polygamy, machinate, frieze, penurious, sulphureous, technical, cede, sleigh, pelisse, erysipelas, honorable.

GRAMMAR.

1. What is meant by parts of speech? Name the parts of speech in the English language.

2. Define parsing, analysis, personification, enallage and pleonasis.

3. Write sentences illustrating the difference between co-ordinate and subordinate connectives.

4. How is the passive voice of verbs formed?

Ans.—By adding the verb to *be* or one of its inflections to the perfect participle of a transitive verb.—*Burns*.

5. What is a finite verb? State the difference between a finite and infinite verb.

Ans.—(2) One is limited in person and number by a subject and the other is not.

6. When is one noun in apposition with another? Illustrate by examples.

7. Name the three degrees of comparison, define each, and compare near, front, and straight.

Ans.—Near, nearer, nearest. The others are not compared.

8. How are sentences divided with respect to form? Illustrate by examples.

9. Bring *what* you found. We thought *him* to be a *gentleman*. He was anxious to secure the situation. *Playing* ball is good exercise. Parse italicized words.

Ans.—*What* is a compound relative, the antecedent part being the object of *bring*, and the relative part, of *found*.

Him is the object of *thought* and *gentleman* object after *to be*.

To secure is an infinitive, with the construction of an adverb, limiting *anxious*.

Playing is a present participle, and has the construction of a noun, subject of *is*.

10. Analyze: The accusing angel flew up to Heaven's chancery with the oath, and blushed as he gave it in. And the recording angel, as he wrote it down, dropped a tear on the word, and blotted it out forever.

	the	(and)	
angel	accusing		angel
	up		recording
flew	with oath	the	dropped
	to chancery	Heaven's	tear
and			on word
	he		the
blushed	gave	as	he
	it	it	wrote
	in	down	as
		forever	it

	the
angel	recording
	tear
dropped	on word
	the
and	he
	wrote
blotted	it
	out
	forever

Twenty-six applicants were examined on this list, June 6. We do not answer questions that everybody ought to know, or which can be readily found in any text-book. We answer fully the 2d question in history, because "Law's Mississippi Scheme" is not given in some of our histories. In Arithmetic it is deemed expedient to give answers only, and let the reader make his own solutions, though we have found applicants who do not seem to understand the art of writing out good solutions. Some solutions will be published to the most difficult problems. July and August lists will both appear in August number which is to be issued about the 10th of the month.

We clip the following from a recent number of the *Normal Exponent*, edited and published by R. Heber Holbrook. It is amusing to notice the eagerness with which the favored few use up the funds that accumulate through the teachers' examinations. An opportunity to make from two to five dollars an hour at institute work is what gives elasticity to the conscience of even a School Examiner. But Mr. Holbrook's criticism does not apply to Darke county, unless some member of the board should hereafter digress.

There are at least twenty Examiners in the State of Ohio, who will be flagrant law breakers this summer. They will carry on private schools, at which tuition will be charged, and which many candidates for county certificates will attend as the *surest* method of obtaining the certificate. But there are many Examiners who will be so shamelessly regardless of law as to conduct institutes, though Examiners at the same time. Teachers should put a stop to it. One word of protest from an honest teacher will make such an Examiner tremble. The trouble is, the whole swindle is by "unanimous consent," and involves the teachers of the county who tolerate it.

The following, "Practical Counsel to Candidates for Examination," from the *Canada School Journal* of April, 1884, deserves a wide circulation. It is given by Mr. J. G. Fitch, one of Her Majesty's senior Inspectors of Schools. J. H. W. Schmidt, Capital University, Columbus, Ohio, furnished it for insertion. Mr. Fitch should have added something about the practice of obtaining assistance from others or from pocket memoranda during the examination.

I have known well-qualified students fail to do themselves justice in an examination through want of attention to two or three simple matters. The knowledge which you have been diligently accumulating in the past years will not tell in the examination unless you can set out, clearly and concisely, the result of that acquisition on paper in a limited time. Carefully read through all the questions before you begin to answer any; a little time spent in this way is well-spent. Then I think it is a good plan to begin with the question which you feel you can answer best. By the time you have come to the end of your answer you will find how much of confidence and self-possession you have gained, and how much less formidable other questions appear. Before you attack any question study the terms of it carefully. An examiner generally takes pains to word his questions so that there can be no doubt as to what he does and what he does not want. But in reading examination papers I am often surprised to see how many very good answers are written to questions which are not asked. At first glance a question may seem like one you have seen before, or may seem to demand something which you know well; you begin hastily, and discover too late, or perhaps never discover at all, that your answer is irrelevant. I will give you an instance. At last year's examination this question was set in history: "Describe the causes that led to the American War, and some of the most important consequences that resulted from it." A number of students plunged briskly into a full account of the American War. Perhaps they had recently had a lecture upon it. So Bunker's Hill, Lexington, the character of Washington, and I know not what besides, were discussed at length; whereas, you see, the examiner had advisedly set a question which did not ask for these details at all; but only for some of the previous and succeeding circumstances. I daresay that as he struck out answer after answer for irrelevancy he grew rather displeased, and, between ourselves, it is never very good policy to put an examiner into an ill temper.

ENGLISH GRAMMAR.

Answers to Queries.

1. Please diagram the following sentences in the old edition of Harvey's Grammar which are not given in Eubank's Key.

LEWIS BROWN.

[p. 223—63]. That's certain; I for my part knew the tailor that made the wings she flew withal.

([] that is-certain and (I for part my knew tailor the (that made wings the she flew withal [which]	Withal [= with] is a preposition, governing <i>which</i> understood.	

[p. 223—65]. Then say not man's imperfect, Heaven in fault; Say, rather, man's as perfect as he ought.

(You then not (that) (man is-imperfect and (that) (Heaven is in fault but (you rather (that) (man is-perfect (he ought as	as he ought as	

[p. 224—75]. Fate seemed to wind him up for four-score years: Yet proudly ran he on ten winters more: Till like a clock worn out with eating time, The wheels of weary life at last stood still.

(Fate seemed-to wind yet he on proudly ran for winters (wheels of life weary stood-still at last like clock a worn out with eating time	him up for years four-score ten more the till at last a worn out with eating time	

Still is a predicate adjective, referring to *wheels*. *To wind* has the construction of an adjective in the predicate with *seemed*.

QUERIES.

1. Parse and diagram—He is *more than twice as old as his father*. J. F. ENGLE.

2. Diagram and give construction of words in italics.

ED. RYNEARSON.

How many thousands of my poorest subjects
Are at this hour *asleep*! O sleep! O gentle sleep!
Nature's soft nurse, how have I frightened thee
That thou no more will weigh my eyelids down,
And steep my memory in forgetfulness?
Why rather, sleep, *liest* thou in smoky cribs
Upon uneasy pallets *stretching* thee,
And *hushed* with buzzing night-flies to thy slumber
Than in the perfumed chambers of the great,
Under the canopies of costly state
And lulled with sounds of sweetest melody.—*Shakespeare*.

3. Correct, if necessary, and explain the following: BuB.

1. Let's me and you take a walk in the garden. 2. Often touching will soil silver. 3. The event occurred ten years since.

4. Diagram—When it was winter, and the snow lay all around, white and sprinkling, a hare would often come jumping along and spring right over the little fir-tree. Id.

Answers should be received on or before Aug. 6.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

457. Is there a bridge across the Nile at Cairo?

Ans.—An iron bridge has been erected over the Nile between Kasr ed Dubara on the right bank and Gezirah on the left.—*Britannica, Art. Cairo*.

504. Give cause of difference between the English and American inch.

Ans.—The *English* inch is the $\frac{1}{36}$ th part of the imperial standard yard. The *American* inch is also the $\frac{1}{36}$ th part of the same standard imperial yard; consequently there is no difference between the English and American inch.

A copy of the imperial standard yard was made many years since by Mr. Troughton for the United States Government. This copy by Mr. Troughton is known as the Troughton scale, and has been accepted and used as a standard in the United States. When it was discovered that the Troughton scale differed by a small quantity from the original standard of which it had been supposed to be an exact copy, the $\frac{1}{36}$ th part of the Troughton scale was very unfortunately called an American inch, a misleading and confusing term, now abandoned.

There is no distinctive American inch, but the inch of England and of the United States is the $\frac{1}{36}$ th part of the imperial English standard yard.

MARCUS BAKER.

556. Who is president of Oxford College? J. E. FELLERS.

Ans.—The Head Master of Christ College, Oxford, England, is Dean Liddell.

558. Are James and Harry Garfield attending school now, and if so, where?

Ans.—They both graduate from Williams College this year.

588. Of what illustrious English statesman was it said that “he had a head to contrive, a tongue to persuade, and a hand to execute”?

The correct answer to this query is John Hampden, instead of Wm. Pitt, as given in *May Visitor*. See *Olney's U. S. History*.
JOHN KNIESLY.

601. What noted events occurred on the 19th of April?

Ans.—Supplementary to Ans. *May Visitor*. The ten anniversary events of April 19, as given by C. A. Sebring, May No., are interesting and instructive. Hoping more will be more so, I add twenty of a more diversified kind. The list is not exhaustive, but will suffice as a supplement. A correct list of thirty or more prominent events for every day in the year, would be a valuable addition to the usual text-books. Events related on the anniversary day of their occurrence, are pleasingly received and hence long remembered.

APRIL 19, 481 B. C.—There was a solar eclipse noticed by Herodotus.

APRIL 19, 1529.—Six Lutheran princes protested against a decree of the Diet, and hence were called *protestants* by the emperor Charles V.

APRIL 19, 1560.—Death of Melancthon the reformer.

APRIL 19, 1608.—Death of Thos. Sackville, the English statesman and poet, who wrote the tragedy of *Gorboduc*, the first regular play on the English stage.

APRIL 19, 1669.—Death of Dr. George Bate, court physician to Charles I., Cromwell, and Charles II., but he could not keep the head of Charles I. on the royal shoulders.

APRIL 19, 1684.—The Synod of Edinburg extended the time for confirmation of children in the Scotch Kirk, from the age of 8 to 16.

APRIL 19, 1689.—Death of the infamous English judge Jeffries in the tower of London.

APRIL 19, 1689.—Death of queen Christina, daughter of the “Snow King” of Sweden. She abdicated the protestant throne and became a Catholic.

APRIL 19, 1692.—Rev. Geo. Burroughs executed at Salem, Mass., for witchcraft.

APRIL 19, 1739.—Death of Nicholas Saunderson, the blind mathematician and friend of Isaac Newton.

APRIL 19, 1779.—Sir Wm. Herschel measured two spots on the sun. This was the first careful measurement of solar spots.

APRIL 19, 1791.—Death of the famous arithmetician Dr. Richard Price of England. He was also known as a theological, political and scientific writer.

APRIL 19, 1797.—Marshal Moreau gained a complete victory over the Austrians at Kehl.

APRIL 19, 1813.—Dr. Benj. Rush, a famous physician and a signer of the Declaration of Independence, died.

APRIL 19, 1824.—Lord Byron died at Missolonghi in western Greece, at the age of 36.

APRIL 19, 1831.—Dissolution of President Jackson's cabinet.

APRIL 19, 1861.—Blockade of the confederate ports by President Lincoln.

APRIL 19, 1861.—The “first blood” of the war of Secession shed in Baltimore from the veins of Luther C. Ladd and O. A. Whitney, of Lowell, Mass., who were the first persons killed in the war.

APRIL 19, 1881.—Death of D'Israeli, Lord Beaconsfield. On the 19th of April, 1885, the “primrose pilgrims” decorated his statue with wreaths of his favorite flower, the primrose. The queen sent a magnificent wreath for the occasion.

APRIL 19, 1882.—Death of Dr. Charles R. Darwin, the founder of “Darwinism.” His grandfather Dr. Erasmus Darwin, author of “Zoonomia” and the “Botanic Garden,” died on the 18th of April, 1802.

N. B. WEBSTER.

624. What was meant by saying that, "Clay was in the succession," and when used? ED. RYNearson.

Ans.—Henry Clay had been Secretary of State under J. Q. Adams, and as it had been the Secretary of State during the three preceding presidential terms who had become the president elect as soon as their terms of Secretary had expired, it could justly be said in 1828 that "Clay was in the succession."

R. J. TOTTEN.

His continued aspirations, being three times candidate for the presidency. First in 1824, when he could not be successful in the House of Representatives, as Adams, Jackson and Calhoun had more electoral votes than he had, he lent his influence in behalf of Adams. Second time in 1832, when he was defeated on account of his Compromise Bill. Third time in 1844, when his opposition to the annexation of Texas defeated him.

W. H. PErson.

625. Who was President from 1787 (the adoption of the Constitution) to 1789? Id.

Ans.—Cyrus Griffin, of Virginia. It is true the Constitution of the United States was agreed to by the convention that formed it in 1787, but it was not *adopted* or ratified by a quorum of nine states till June 21, 1788. Rhode Island did not adopt the Constitution till May 29, 1790.

N. B. WEBSTER.

There was no President. * * * * The new government was not then in operation.—*Scudder's History of the U. S.*, p. 247.

W. H. PErson.

627. Give a short sketch of "The Venerable Bede."

M. T. PATE.

Ans.—Beda or Bede, called "the Venerable" on account of his piety and learning, was born near Wearmouth in Durham, 673 A. D. At 7, he entered the monastery of St. Peter at Wearmouth, where he remained for 13 years under the care and instruction of the Abbot Benedict Biscop and his successor Ceolfrid. The monk Trumberct gave him religious training and his music master was John, chief singer in St. Peter's church, Rome, who had been called to England by the Abbot Benedict. After completing his studies at this place, he was taken to the twin-monastery of St. Paul, (now written Jarow) founded in 682. Here he took the deacon's order and at 30 he was ordained priest by John Beverly, then Bishop of Hexham. He now consecrated his life to literature, including Latin, Greek and Hebrew, and medicine, astronomy, industry, piety. He wrote bible commentaries, hymns, biographies, scientific treatises, and an "Ecclesiastical History of England," in five books to which we are indebted for almost all the information we have of England down to 731 A. D. When laboring under disease and near the close of his life, he was engaged in a Saxon translation of St. John's Gospel, dictating his version to his pupils. His works have been published in London, comprising 12 large volumes. He died May 26, 735, and was buried in the monastery of Jarow. See *People's Encyclopedia*.

ED. RYNearson.

628. What general left behind his wooden leg and in what battle? Id.

Ans.—In the battle of Cerro Gordo, April 18, 1847, the Mexicans were so disastrously beaten that they fled with such haste that Santa Anna only escaped on his mule, leaving behind him his wooden leg.

J. WOMELSDORF.

629. What sum of money did our government grant to render the Morse Telegraph possible? WM. TAIT.

Ans.—The sum of \$30,000. Of 89 congressmen who voted for the appropriation, Hon. R. C. Winthrop alone survives. There were 83 votes against it. Prof. Morse was so poor at this time that he had only 37½ cents. His salary was fixed at \$2,500.

N. B. WEBSTER.

Congress, at midnight, and the closing hours of the session of 1843 appropriated \$30000 for an experimental line between Washington and Baltimore.

J. F. ENGLE.

Congress appropriated \$30,000 to construct a telegraph line of 40 miles. It was completed in 1844, and was successfully operated by Prof. Morse. It was the first line established in the world.

JOHN KNIESLY.

630. What was the Tripartite Treaty?

JNO. KNIESLY.

Ans.—France and England, fearing the U. S. would annex Cuba to their possessions, entered into a tripartite treaty with the U. S., all agreeing to leave it remain in the possession of Spain. See Ridpath's U. S. History, p. 468.

JOHN FITZGERALD.

First, a triple alliance concluded in 1668 at the Hague, between England, Holland and Sweden, having for its object the protection of Spanish Netherlands and the checking of the conquest of Louis XIV., of France. Second, an alliance concluded in 1717, between Great Britain, France and Holland against Spain.

E. B. HIESTAND.

The tripartite treaty was the Treaty of Paris in 1856, which terminated the Crimean or Russo-Turkish war, in which England and France acted a conspicuous part. The pen with which the treaty was signed was made of an eagle's quill, set with diamonds, and was presented to the Empress Eugenie.

N. B. WEBSTER.

631. What Queen was so affected by the failure of her army to take a certain city, that she said its name would be found upon her heart after her death?

Id.

Ans.—Queen Mary Tudor (bloody Mary) said when the Duke of Guise captured Calais in France from the English, Jan. 7, 1558, "When I am dead Calais will be found written on my heart." It was not because her army failed to take the city which had been taken for England by Edward III., Aug. 4, 1347, but because the French army did not fail to take it. If the *post mortem* was made, it is more probable that the "find" was *callous*.

N. B. WEBSTER.

632. Where is the earliest mention of the earth having orbital motion?

A. M. SCRIPTURE.

Ans.—By Pythagoras about 530 B. C.

N. B. WEBSTER.

633. Who wrote "Home, Sweet Home"?

Id.

Ans.—John Howard Payne, an actor and dramatist, who was born 1792 in New York wrote the words. In 1813 he sailed for England and made his first appearance in London at Drury-Lane Theatre, as Master Payne. He returned to America in 1832, and in 1841 he was appointed American Consul at Tunis, recalled in 1845 and re-appointed in 1851. He died there April 10, 1852, and a few years ago his remains were brought to America.

W. H. PERSON.

John Howard Payne born in New York 1792 died at Tunis April 10, 1852. During the greater part of his life, he was an actor, and showed great dramatic ability. "Home, Sweet Home" (adapted to an old Sicilian melody) occurs in his play, "Clari, or the maid of Milan." He has acquired a lasting reputation as author of this piece, it having been translated into nearly every language on the globe.

J. F. ENGLE.

635. Who appoints the "Senators" in the House of Parliament of the Dominion of Canada?

J. W.

Ans.—The Governor General of the Dominion of Canada appoints them. Their office is for life or until they are not worth \$4000.

N. B. WEBSTER.

638. What people are called "arsenic eaters"?

Id.

Ans.—The hunters of the mountains of Tyrol, and foolish girls who wish to look plump and rosy at the cost of health and life.

N. B. WEBSTER.

639. From what did Mount Vernon receive its name?

G. L. SHANER.

Ans.—The Washington estate, consisting of 7,000 acres, was bought by Lawrence Washington, George's elder brother, who settled there in 1743, and built the mansion. He named the place after Admiral Vernon under whom he had served in the British navy.

J. WOMELSDORF.

640. Who is the sick man of Europe and why so called?

B. F. FINKEL.

Ans.—A name popularly given to the Turkish Empire. It originated with the Emperor Nicholas of Russia. In his conversation at St. Petersburg Jan. 11, 1844, he said, "We have on our hands a very sick man. It would be a great misfortune, if, one of these days, he should happen to die before the necessary arrangements are all made."

JOHN FITZGERALD.

Turkey was called the sick man of Europe by the Czar Nicholas, who made a false diagnosis at the time. The wish was father to the thought.

N. B. WEBSTER.

J. K. P. SAYLER.

641. What is the "Atlantis" Theory?

Id.

Ans.—This is a theory that there was once either a continuous belt of land between the eastern and western continents, or else a great island across which communication was easy, and that this land becoming submerged during some of the great changes which have taken place on the earth's crust, the two countries, with their people, were widely sundered. This supposed island was called *Atlantis*, hence the name of the theory.

J. WOMELSDORF.

The title of an allegorical fiction by Lord Bacon, and the name of an island described in it as being situated in the middle of the Atlantic Ocean. Bacon represents himself as having been wrecked on this island and as finding there an association for the cultivation of natural science and the promotion of improvements in the arts.

JOHN FITZGERALD.

According to ancient tradition, *Atlantis* was the name of a vast island in the Atlantic Ocean, first mentioned by Plato.

J. K. P. SAYLER.

642. What was the plan of Iguala? Give incident.

Ans.—Feb. 21, 1824, under the influence of affairs in Spain, Don Augustin Iturbide, a native Mexican officer, having made efforts to begin the second revolution, proclaimed Mexico independent, with a plan of government that would make it a constitutional monarchy. His work was successful in arousing the people, and he shortly had the whole country at his command. The plan contemplated the offer of the throne to a Spaniard, and has been known as the "Plan of Iguala."

ED. RYNEARSON.

643. Who was known among the Indians as the Sleepless Chief?

Gen. Anthony Wayne (Mad Anthony) who defeated the Indians on the Maumee River during Washington's administration. He made a treaty with them, which, he said, if they did not keep, he would rise from his grave to fight them. Indians said of him, "The whites have a leader that never sleeps."

J. F. ENGLE.

644. What Generals were known as the "Iron Man", and "Old Probabilities"?

Id.

Ans.—The Duke of Wellington was known as the *iron duke*, and Miss Martineau called John C. Calhoun the *iron man*, but he was not a general. The name has been applied to Stonewall Jackson and I believe to Gen. Grant. Commodore Hull was called *Old Ironsides*, and doubtless the term has been applied to many military men, either seriously or ironically. Gen. Albert J. Meyer, Chief Signal Officer was known as "Old Probabilities."

N. B. WEBSTER.

Gen. Israel Putnam was styled the "Iron Man."

C. E. M.

645. In plastered ceilings the location of the laths and joists can be seen on the surface of the plastering by light and dark streaks. Can you account for it?

L. B.

Ans.—The light streaks under timbers of plastered ceilings of old buildings and the dark streaks between them, are due to the straining out of the dust from the air which filters through the plastering where not prevented by the joists or laths; where no such filtration takes place there is no deposit of dust.

N. B. WEBSTER.

CREDITS.

GEO. L. SHANER, *Stewart's Station, Pa.*, 639.

J. WOMELSDORF, *Lock Haven, Pa.*, 627, 633.

W. H. PERSON, *Bath, Pa.*, 628, 629.

JOHN KNIESLY, *Horatio, Ohio*, 633, 640, 643.

E. B. HESTAND, *Hagerman, Ohio*, 627, 629, 635.

J. E. FELLERS, *Edina, Mo.*, 627, 633, 639.

ROBT. J. TOTTEEN, *New Wilmington, Pa.*, 633, 640.

WARREN LOY, *Pymont, Ohio*, 629, 630, 633.

C. CHAVIS, *Spartansburg, Ind.*, 628, 629, 633.

J. F. ENGLE, *Bainbridge, Pa.*, 627, 628, 639, 644.

JOHN FITZGERALD, *Greenville, O.*, 624, 625, 627, 628.

ED. RYNEARSON, *Gettysburg, Ohio*, 628, 629, 641, 643.

PROF. N. B. WEBSTER, A. M., *Norfolk, Va.*, 627, 628, 630, 633, 634, 639, 641.

J. K. P. SAYLER, *Romeo, Tenn.*, 624, 625, 627, 628, 629, 630, 633, 639.

QUERIES.

669. Give the name and year of all the established Wedding anniversaries.

LIBRA.

670. State the notable events that occurred July 4.

Id.

671. Give a brief history of Easter, and the date of its occurrence for each year in the 19th century, with method of calculating the same.

Id.

672. Why do the edges of boards turn up when one side of board is exposed to the sun's rays?

WARREN LOY.

673. What can be said of the antiquity of Astronomy? When were the sun spots discovered?

Id.

674. Name political divisions of Africa at the present time.

J. FINNEY ENGLE.

675. Give the provisions of the treaty of Ghent, 1814.

Id.

676. Locate and describe the U. S. Magnetic Observatory, and tell for what it was established.

C. A. S.

677. Give the nature of the famous *Credit Mobilier*, and its history in brief.

ROBT. J. TOTTEEN.

Ans.—See *School Visitor*, Vol. IV., p. 79.

678. Was there any circumstance in connection with the life of Tennyson, that caused him to write "Locksley Hall"? What can be said to be the key note of this poem?

Id.

679. Upon the strength of what productions especially can Bryant, Whittier, Longfellow, Lowell, Bayard Taylor, and Holmes lay claim to an immortality? *Id.*

680. By whom and under what circumstances was the following said: "Choose, each man, what best becomes a brave Castilian. For my part I go to the south"? *ED. RYNEARSON.*

681. Where is the highest city on the globe, and when founded? *Id.*

682. Give the origin and meaning of the phrase, "The skeleton in every closet." *E. B. HIESTAND.*

683. Who invented the electric light? *Id.*

684. Who presented Cornwallis's sword to Gen. Lincoln at Yorktown? *JNO. KNIESLY.*

685. Why is the presiding officer of the House of Representatives called the Speaker? *Id.*

686. Give author of the book, *The Wonders of the Invisible World.* *JOHN FITZGERALD.*

687. Give an account of the persons known as, "The Happy Old Couple." *Id.*

688. Who was "Judas of the West"? Give incident. *Id.*

689. Why does the sun or moon appear larger when near the horizon? *S. A. SMITH.*

Ans.—The *Britannica* says that it is an optical illusion. Full answer in *School Visitor*, Vol. III., p. 195.

690. Describe the monument in the U. S. that stands on the 77th meridian. *Id.*

691. Give reason for Rhode Island's two capitals? *CLARA BURK.*

692. Give the origin of the word *skedaddle*? *M. T. PATE.*

693. Who is the author of: "The worst men often give the best advice. Our deeds are sometimes better than our thoughts." *Id.*

694. Is Capt. John Smith's, *True Relation of Virginia*, still in existence? If so, where can it be obtained? *JNO. GOTTSCHALL.*

695. In the *Library of Universal Knowledge* (from Chambers Enc.) it is stated, in treating of Probabilities, that the product of 1, 3, 5, 7, 9 . . . 28999, can be easily, approximately obtained by the higher analysis. What branch of higher analysis and what author? *W. L. H.*

696. Give a brief explanation of Dr. Franklin's experiment, by which he drew the lightning from the clouds and confined it, to prove its identity with frictional electricity. *J. W. DEBERRY.*

697. When and how was slavery abolished in the District of Columbia? *NEMO.*

698. "Decoration Day" always comes on May 30. Can you tell why and when this date was established? *Id.*

699. What is the difference in the height of the Pacific Ocean and the Caribbean Sea, as found in the survey of the Panama Canal?

Answers should be received on or before Aug. 6.

BOOK NOTICES.

DEMOREST'S ILLUSTRATED MONTHLY MAGAZINE for July is unusually bright and entertaining. It contains some exceedingly readable articles, among which are "Among the Sea Islands of Georgia," "The Chinese Exhibit at the New Orleans Exposition," both of which are illustrated, "The Conjugal Poets," "Edward Jenner," the originator of Vaccination, "Chautauqua Lake and Chautauqua School," and "Shall I get a Camera?" by Professor Barnard. Jenny June furnishes a paper, "Can Women Travel Alone?" and the various departments are, as usual, replete with instructive information. The frontispiece is an oil picture, "Spring-time of Love."

MESERVEY'S BOOK-KEEPING. Single and Double Entry. By A. B. Meservey, Ph. D. Published by Thompson, Brown & Co., Boston. Price for sample copy only 50 cents.

Here is an excellent text-book of 222 pages, easy enough to be comprehended by pupils in our common schools, and hard enough to require real study. It is sufficiently comprehensive for all practical purposes, advancing by easy grades through five forms of single, and six forms of double entry. The proper method teaching this valuable art and science in the common schools is well illustrated by the method of questions and answers which the author gives in the first half of the book. Fine illustrative examples are given with red lines, and entries that should be written with red ink are printed red. We commend it to those who desire a good text-book for elementary work.

GRAMMAR AND ANALYSIS MADE EASY AND ATTRACTIVE BY DIAGRAMS. Containing all the Difficult Sentences of Harvey's Grammar Diagrammed; also, Many Difficult Sentences from Other Grammars; Designed for both Teachers and Pupils. By Frank V. Irish, A. M. Published by Van Antwerp, Bragg & Co., New York and Cincinnati. Octavo, Cloth, 118 pp. Price by Mail, prepaid, \$1.25.

No progressive teacher doubts the utility of diagrams in the study of *Analysis* and the straight-line system used in this work is peculiarly simple in its elements and gives a clear view of the sentence as a whole. It was devised and first used by Prof. W. F. L. Sanders, of Cambridge City, Ind., in his admirable work, *The English Sentence*; but Prof. Irish has made some changes which he claims to be improvements. The book before us is artistic in every respect, and it will be a great help to the young teacher, as well as to the pupil, who is eager to master the various difficulties in the construction of words and the relation of elements in the "English Sentence." The parsing of difficult words is indicated by figures which refer to the rules in Harvey's Grammar. Its title is so comprehensive that we forbear speaking further of its scope. We heartily recommend the book to all interested.

For the first time in its history Whitley Co., Ind., has a Republican County School Superintendent, the township trustees having, on last Monday [June 1], elected Alex. Knisely, to this high, honorable and dignified position. This is a high compliment worthily bestowed, and it is only the more complimentary to Mr. Knisely since the office was entirely unsolicited upon his part. Mr. Knisely is a native of Whitley Co., is the third son of the late Judge Knisely, is unmarried, and is about thirty-four years of age. He is a perfect gentleman in all that the term implies, unassuming, dignified and accomplished. — *Columbia City Commercial*.



EDITED BY

JOHN S. ROYER.

VOL. VI.

AUGUST, 1885.

No. 8.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

745. *By W. L. HARVEY, Maxfield, Me.*—A man drops a shell from a balloon which explodes on reaching the ground. It takes the sound after the explosion as long to reach him as the shell is falling. If sound moves 1120 feet per second, how high was the man from the earth?

By L. A. REED, 75 Woodland Court, Cleveland, Ohio.

Let x = No. of seconds the shell was falling to the earth. The total space fallen through would be $x^2 \times 16\frac{1}{2}$, not taking into consideration the resistance of the air. Then

$$16\frac{1}{2}x^2 = 1120x, \text{ or } x = 69\frac{2}{3}.$$

The required height is therefore $69\frac{2}{3} \times 1120 = 77,993\frac{1}{3}$ feet.

Solved by R. A. Leisy, A. L. Foote, Prof. H. A. Wood, Prof. J. C. Corbin, W. T. Mooney, Hon. J. H. Drummond and Wm. Wiley.

746. *By J. C. ROEBUCK, Rock Falls, Iowa.*—In how many different ways can a man travel from one corner of a township 6 miles square to the opposite corner, following section lines.

By A. L. FOOTE, Hempstead, Long Island.

The required number is the last term in the following series:

2	3	4	5	6	7
3	6	10	15	21	28
4	10	20	35	56	84
5	15	35	70	126	210
6	21	56	126	252	462
7	28	84	210	462	924

The correct answer is 924, found thus: Place the digits 2-7 in a vertical and horizontal line as shown, find the figures in each line; as in second, $3+3=6$; $6+4=10$; $10+5=15$; $15+6=21$; $21+7=28$.

747. *By the same.*—If solvable, how many rows with $b=5$ trees in a row can be planted with $a=33$ trees?

By PROF. H. WOOD, 204 East 51st St., New York.

By arranging 21 trees as shown in the triangle ABC , we have 9 rows with 5 trees in a row. Arranging 12 more as shown in the triangle ADE , adds three more rows, or the 33 trees in 12 rows. E By a similar device any number of trees above a certain number, may be arranged in rows with 5 D trees in a row. In general if b =the number of trees in a row, and a =the number of trees, devices may be employed by which the required arrangement may be made in most cases, provided a is considerably larger than b .

748. *By* G. H. HARVILL, Ada, La.—Required the length of the diagonal of a cube the length of whose side is S .

By WM. WILEY, Detroit, Mich.

The diagonal d of one face is $s\sqrt{2}$. The diagonal of the cube is the hypotenuse of a right triangle of which d is one leg and s the other, or $(s\sqrt{2})^2 + s^2 = \sqrt{3s^2} = s\sqrt{3}$.

By R. A. LEISY, Marshallville, Ohio.

Solve all such problems by this rule: *Multiply the square of the length of the side by 3, and extract the square root.* Hence $s^2 \times 3 = 3s^2$, and the answer is $\sqrt{3s^2}$.

Solved by Messrs. Drummond, Wiley, Roebuck, Corbin, Wood.

750. *By* A. F. PARSONS, Arroyo Grande, Cal.—Divide a given semi-circle into two equal parts by a line at an angle σ with the diameter.

By H. A. WOOD, New York City.

Let O be the center of the circle, AB the diameter, AC the line which divides the semi-circle into two equal parts, and θ the angle BAC which we are to determine.

Draw the radius OC , and OD perpendicular to AC . By the conditions the segment $ALC = \triangle AOC + \text{sector } BOC$.

The $\triangle AOC = R^2 \sin \theta \cos \theta$, the sector $BOC = \frac{1}{2} R^2 \times 2\theta$, and segment $ALC = \frac{1}{2} R^2 (\pi - 2\theta) - R^2 \sin \theta \cos \theta$. Put $R=1$, then $2 \sin \theta \cos \theta + 2\theta = \frac{1}{2} \pi$, or $\sin 2\theta + 2\theta = \frac{1}{2} \pi$. In this equation θ is easily determined by trial. Reducing, we find $\theta = 23^\circ 49' 36\frac{1}{2}''$.

R. A. Leisy, A. L. Foote and W. L. Harvey solved it.



751. By H. A. WOOD.—*New York City*.—If r be the radius of a circle, how far from the center must a chord be drawn parallel to the diameter to divide the semi-circle into two equal parts?

By W. L. HARVEY, *Maxfield Me.*

Let $x = OE$ (fig. in solution of 750); then $\sqrt{(r^2 - x^2)} = FG$ and area of $\triangle HGO = x\sqrt{(r^2 - x^2)}$; also when $\varphi = \text{angle } HOG$, we have $\frac{1}{2}r^2\sin\varphi = \triangle HGO$. $\therefore x\sqrt{(r^2 - x^2)} = \frac{1}{2}r^2\sin\varphi \dots (1)$. $\frac{1}{2}r^2\varphi - \frac{1}{2}r^2\sin\varphi = \frac{1}{4}r^2\pi$, area of seg. HEG ; or $\varphi - \sin\varphi = \frac{1}{2}\pi \dots (2)$. To solve such equation, S. E. Benjamin of Patten, Me., has devised a very neat method.

Put $\varphi = a + z$, and $\sin\varphi = \sin(a + z) = \sin a \cos z + \cos a \sin z$, and (2) becomes $z - \sin a \cos z - \cos a \sin z = \frac{1}{2}\pi - a \dots (3)$. Find by trial a near value of $\varphi = a + z$, and make a equal to it, the object being to make z as small as possible.

$$\cos z = 1 - \frac{z^2}{2} + \frac{z^4}{1.2.3.4}, \text{ etc.} \quad \sin z = z - \frac{z^3}{1.2.3} + \frac{z^5}{1.2.3.4.5}, \text{ etc.}$$

Using the expansion of $\cos z$ to z^2 , and $\sin z$ to z^3 , (calling $\cos a = c$ and $\sin a = s$) and substitute in (3), we have

$$z^3 + \frac{3sz^2}{c} - 6z + \frac{6z}{c} = \frac{6(s + \frac{1}{2}\pi - a)}{c} \dots (4).$$

Evidently angle GOF exceeds 60° , say 65° ; then $a = 130^\circ$ and $\sin a = 50^\circ = s = .7660444$, and $\cos a = (\cos 180^\circ - a) = -\cos a = -c = -.6427876$. Using these numbers in (4), we have

$$z^3 - 3.57526z^2 - 15.33434z + .633920 = 0 \dots (5).$$

From (5) $z = .00409469$ or $2^\circ 20' 45''$, and $\sin\varphi = \sin(130^\circ + z) = .7390892$. Substituting in (1), $x = .40396r$, the required distance.

By the PROPOSER.

In the semi-circle AEB (Fig. 750) let HG be drawn parallel to the diameter AB , dividing the semi-circle into two equal parts. On OE perpendicular to AB , let $OF = x$, the distance required, and $\varphi = \text{angle } GOB$. Then $x = r\sin\varphi$, $FG = r\cos\varphi$, area sector $GOB = \frac{1}{2}r^2\varphi$, area sector $EOG = \frac{1}{2}r^2(\frac{1}{2}\pi - \varphi)$, and $\triangle FOG = \frac{1}{2}r^2\sin\varphi\cos\varphi$. We then have

$$r^2\varphi + r^2\sin\varphi\cos\varphi = r^2(\frac{1}{2}\pi - \varphi) - r^2\sin\varphi\cos\varphi.$$

Transposing and reducing we have $\sin 2\varphi + 2\varphi = \frac{1}{2}\pi$, the identical equation deduced in the previous example. Hence $\varphi = 23^\circ 49' 36\frac{1}{2}''$, and $x = .403974r$.

Solved by Messrs. Foote and Wiley.

752. By WM. WILEY, *Detroit, Mich.*—Suppose x and y are integers. It is required to find integral values for $xy \div [x + y]$.

By H. A. WOOD, New York City.

Put $xy \div (x+y) = m \dots (1)$, in which m is to be an integer. Then $xy = mx + my$, and $x = my \div (y-m) \dots (2)$. By using these two equations, any number of values may be found which will give an integral value to the expression.

1. Any integral values assumed for m and y , in equation (2), provided y is one greater than m , will give an integral value for x .

2. If $y = 2m$, x will be integral. If y is any other multiple of m , x will not be integral.

3. If $x = y$, and is even, the expression will be integral. x and y cannot both be odd. To illustrate: If $x = 4$, and $y = 4$, $m = 2$; if $y = 6$ and $m = 5$, $x = 30$. In like manner any number of values may be found.

By J. H. DRUMMOND, Portland, Me.

To make $xy \div (x+y)$ an integer, take $x = my$ and we have

$$\frac{my^2}{my+y} = \frac{my}{m+1} \dots (1)$$

Take $y = m+1$, and (1) becomes m .

Hence $y = m+1$ and $x = m(m+1)$, in which m may be any integral number.

Take $m = 1, \dots 2, \dots 3, \dots 4, \dots 5, \dots 6, \dots 7, \dots 8$,

and $y = 2, \dots 3, \dots 4, \dots 5, \dots 6, \dots 7, \dots 8, \dots 9$,

and $x = 2, \dots 6, \dots 12, \dots 20, \dots 30, \dots 42, \dots 56, \dots 72$, and so on.

By J. C. CORBIN, Little Rock, Ark.

The relation $y^2 - y = x$, or $(y-1)y = x$, will, by substituting any integer for y , give an indefinite number of values x , since $xy \div (x+y) = y-1$, an integer, when $x = y^2 - y$. Or, let $y =$ any integer, then y multiplied by the number preceding it $= x$. Since the given expression represents the side of an inscribed square in terms of the base and altitude of the triangle in which it is inscribed the problem might be enunciated thus: To find a triangle of such dimensions, base and altitude, that the side of the inscribed square and those dimensions shall all be integral.

Solved by MESSRS. Foote, Mooney, Roebuck and the Proposer.

753. *By the EDITOR.*—At what time between 12 and 2 o'clock is the minute hand as far from I. as the hour-hand is from XII.?

By A. L. FOOTE, Hempstead, N. Y.

This will occur *five* times, viz.: at 1 o'clock and twice before, and

twice after 1 o'clock. First let x =space the hour hand has left the 12 then $(5-x)$ is the space passed over by the minute hand in same time, but these spaces are as 1 : 12, then we have $x : 5-x :: 1 : 12$ or $12x=5-x$. $\therefore x=\frac{5}{13}$, and $5-\frac{5}{13}=4\frac{8}{13}$ minutes past 12 the first time; again let x the distance of hour hand past 12 and the position of the minute hand x past the 1, then we have $x : 5+x :: 1 : 12$, or $12x=5+x$; hence $11x=5$, and $x=\frac{5}{11}$, and $5\frac{5}{11}$ minutes past 12 the second occurrence. The third will be at 1 o'clock. The fourth is $5+x : 70+x :: 1 : 12$ or $x=\frac{10}{11}$; hence $10\frac{10}{11}$ minutes past 1 o'clock. The fifth is $60-x : x :: 12 : 1$ or $x=4\frac{8}{13}$ or at 1 o'clock $55\frac{5}{13}$ min.

By W. T. MOONEY, *St. Mary's, Ohio.*

The min. hand moves over one min. space while the hr. hand moves over $\frac{1}{12}$ of a min. space.

1. At some time between 12 M. and 12:05 P. M. the min. hand is as far from XII. as the hr. hand is from I., and this time is such that added to distance gone by hr. hand will equal 5 min. Hence $5 \div \frac{13}{12} = 4\frac{8}{13}$ min. past 12 is the time.

2. At some time after 12:05, when it is apparent that the diff. of space traveled over by the two hands is 5 min.; $\therefore 5 \div \frac{1}{12} = 5\frac{5}{11}$ min. past 12 satisfies the conditions.

3. At 1 o'clock the hands are in the required positions.

4. If the min. hand gain 10 min. another required position is attained; $\therefore 10 \div \frac{1}{12} = 10\frac{10}{11}$ min. past 1 P. M.

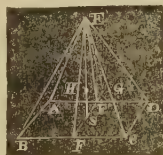
5. The distance traveled by both is $\frac{13}{2}$, or 60 min.; then $60 \div \frac{13}{2} = 55\frac{5}{13}$ min. past 1 P. M.

Elegant solutions by Messrs. Reed, Wood, Wiley and Drummond.

754. *By a farmer.*—The base of a pyramidal stone is 4 by 15; the slant heights of two edges are 13 each, and the other two edges are 14 each. Locate the center of gravity.

By A. L. FOOTE, *Hempstead, Long Island.*

Let $ABCD$ be the base of the stone (which we assume to be a $\square$), and let E be the vertex, EB and EC each 14, and EA and ED each 13. Let EF and EF' be the perpendiculars of the triangles EBC and EAD respectively. Let EG be the perpendicular let fall from the vertex E to the plane of the base at G , and let ES be the line from vertex to center of gravity of base at S . Then we have $EF = \sqrt{(EB^2 - BF^2)} = (14^2 - 7\frac{1}{2}^2) = \frac{1}{2}\sqrt{559}$ and $EF' = \sqrt{(EA^2 - AF'^2)} = (13^2 - 7\frac{1}{2}^2) = \frac{1}{2}\sqrt{451}$. Now $FF' = 4$ and



put $F'G = x$, and we have $EF'^2 - F'G^2 = EF'^2 - F'G^2$, or $5\frac{5}{8}^2 - (4+x)^2 = 4\frac{5}{8}^2 - x^2$, from which $x = 1\frac{3}{8} = F'G$. Also $EG = \sqrt{(EF'^2 - F'G^2)} = \sqrt{[(\frac{1}{8}\sqrt{451})^2 - 1\frac{3}{8}^2]} = \frac{1}{8}\sqrt{7095}$. Then $ES = \sqrt{(EG^2 + SG^2)} = \frac{1}{8}\sqrt{489}$, and H , the point of the center of gravity, is in this line $\frac{1}{4}$ of the distance from S to E , or $\frac{1}{8}\sqrt{489} = 2.764168$. Another very neat solution may be obtained by placing the edges 14 at one end and the edges 13 at the other end of the rectangle, but we shall find the length of ES the same, but the center of gravity will be perpendicularly over the middle of the base lengthwise and at a distance of .2 from the perpendicular to the center of the base.

Wm. Wiley solved it.

Problems for Solution.

770. *By Request.* A gives B \$210 May 11, and takes his note at 5 months, agreeing not to exact interest. A sells the note to C June 11, for \$205, and B makes good to A the \$5 so lost. When the note falls due, C exacts interest at 7% per annum. Find the rate per cent per annum gained, lost or paid by the several parties to this transaction.

771. *By N. R. OLIVER, Dorchester, Ont.*—To what power must I raise 14 so as to produce 123456789?

772. *By the same.*—I found by looking through a window which was 32 ft. from where I stood, a distant building appeared to fill one of the window panes, the pane being 20 inches long. On my approaching to within 3 feet of the window the building appeared to take up 2 inches of the pane, the bottom of the building and pane still appearing coincident. What was the distance of the building from the first point of observation?

773. *By HENRY GUNDEL, New Castle, Ind.*—Let $x^2 \div a^2 + y^2 \div b^2 + z^2 \div c^2 = 1$ be the equation of an ellipsoid. Find the volume of a segment of one base parallel to the plane of (y, z) , and deduce from the result the volume of similar segments of spheroid and sphere.

774. *By A. L. FOOTE, Hempstead, N. Y.*—A man had an empty conic cistern, apex down and open at the top. He had also a large parabolic kettle the diameter of which was greater than that of the cistern. Seeing a rain coming, and being anxious to secure as much water as possible he placed the kettle in the cistern and removed a plug from its bottom to allow the water to pass into the cistern. Had the plug not been removed the part of the kettle within the cone would have been exactly filled by the rain during the storm, which fell d inches on a level. Now admitting the diameter of the kettle to be a inches and its altitude b inches, what was the depth of water collected in the cistern? [Make numerical application.]

775. *By PROF. DEVOLSON WOOD, Hoboken, N. J.* A paraboloidal vessel is partly filled with a liquid, and rotates about its vertical axis with a uniform angular velocity; required the entire pressure against the surface.

776. *By H. A. Wood, New York City.* What is the length in yards of a piece of cloth originally $1\frac{1}{3}$ yds. wide, if the cloth after shrinking $10\frac{1}{2}\%$ in length and width, contains 9 full square yards?

777. *By the same.* Bought an article and sold it for $3\frac{1}{2}\%$ less than it cost me; bought it back again and paid $3\frac{1}{2}\%$ more than I sold it for. I lost \$12 by the operation. What did the article cost me at first?

778. *By J. R. BALDWIN, Blue Grass, Iowa.* If a stright stick six inches long be dropped at random on a floor, which is ruled with parallel lines six inches apart; what is the probability of it falling on a line?

Solutions should be received on or before Sept. 1.

Examination Questions.

ARITHMETIC.

1. What is .2 per cent of .2? Ans. .0004.
2. Define arithmetic, number, digit, axiom, compound number.
3. If stock bought at 10% discount and sold at 5% premium gave \$462.56 profit, what was the amount invested? Ans. \$2775.36.
4. From 18 A., 3 sq. ft., 3 sq. in., take 15 A., 3 sq. rd., 30 sq. yd., 1 sq. ft., 142 sq. in., without reducing the subtrahend.
Ans. 2 A., 3 R., 36 sq. rd., 3 sq. ft., 41 sq. in.
5. A and B can do a piece of work in 12 days, and A can do $\frac{3}{4}$ as much as B. In what time can each do it alone? Ans. A, 30 days; B, 20 days.
6. How long will it take any principal to increase one-half at 8%?
Ans. $6\frac{1}{4}$ yr.
7. If Greenville Bank stock be yielding 8%, and is now 25% above par, how much should be invested to receive an annual income of \$320? Ans. \$5,000.
8. A paid \$3.60 and B \$2.00 for a barrel of flour, how many pounds should each have? Ans. A, 126 lb.; B, 70 lb.
9. The freight on a barrel of coal oil was 5% of the cost, 25% was lost by leakage, the oil remaining sold for 40% above cost, and the empty barrel bro't 2% of the total cost, what was the rate of the gain or loss? Ans. 2%.
10. A ladder 65 ft. long rests against a house, with its foot 16 ft. from the house; if the foot is drawn out 17 ft. further from the house, how far will the top of the ladder slide down the wall? Ans. 7 ft.

GEOGRAPHY.

1. Describe the motions of the earth.
2. How is the change of the day and night produced?
3. Spring begins the 20th of March. summer the 21st of June, fall the 22d of September, winter the 21st of Dec. Why?
4. What is meant by mean annual temperature? How is it represented on our maps?
5. Locate and describe the Zone of Calms.
6. Define winds, clouds, rain, snow, and mist.
7. Locate the Dead, Red, Yellow, Black, and White seas.
8. Name the states of S. A. that border on the Pacific and capital of each.
9. Name states of U. S. that border on the Pacific and capital of each.
10. Locate Bahia, Mazatlan, Rochester, Mamla, and Bombay.
11. What will occur on the 7th, 8th and 9th of July at Chautauqua?

HISTORY.

1. What country first recognized the independence of the U. S.?
2. State what you know of Arnold's treason. Of the witchcraft delusion.
3. Describe Braddock's defeat. During what war and in what year did this occur?
4. Give a short sketch of Jas. A. Garfield.
5. What led the French to aid the Americans in their struggle for independence?
6. Name five leading American generals of the Revolutionary, three of the Mexican and five of the "War of 1812." Also name three important battles of each war.
7. Under whose administration was the Louisiana purchase made? The Alaska purchase? What was paid for each?
8. In what respects did President Jackson differ from his predecessors? Also state his action in regard to the U. S. Bank.
9. In what respects did Penn's Treaty differ from other Treaties made between the Indians and the whites? Account for this difference.
10. What knowledge is acquired by the study of history? How do you teach it? Why?

GRAMMAR.

1. What classes of words in the English language are capable of inflection?
2. Give the different modes. Define each. Give tenses of each mode.
3. Write all the participles, active and passive, of *take*.
4. Write a complex sentence containing an adjective clause and adverbial phrase.
5. Place the proper diacritical marks over "a" in the following: atlas, pall, ask, father.
6. Give the different parts of speech and their respective properties.
7. Explain the difference between ellipsis and abridgement.
8. Write a complex sentence whose clause shall be connected by a relative pronoun in the objective case.
9. Diagram: The earth was made so various that the mind
Of desultory man, studious of change,
And pleased with novelty might be indulged.
10. *Were he ten times the villian that he is, he would still find supporters.*
Parse italicized words.

SPELLING.

Oxygen, cerulean, caisson, separable, hygiene, diffidence, mucilage, lucid, obeisance, supersedure, procedure, ptyalism, besiege, nauseate, italicize, ancillary, maritime, witticism, mutilate, Vera Cruz.

Aug. 1.

ARITHMETIC.

1. State the different ways in which numbers may be represented.
2. What is the local value of a figure? The simple value?
3. How is local value of a figure affected by its removal one order to the left?
4. By analysis: If the $\frac{1}{3}$ of 6 be 3, what will $\frac{2}{10}$ of 40 be? *Ans. 54.*
5. $\frac{3}{4}$ of A's age + 4 years equals $\frac{2}{3}$ of B's, and the sum of their ages is 74 years, what is the age of each? *Ans. A, 32 yr.; B, 42 yr.*
6. Divide \$2000 among A, B, and C, and give A \$240 more than C, and C \$190 more than B. *Ans. A, \$890; B, 460; C, \$650.*
7. After spending 25% of my money, and 25% of the remainder, I had left \$675; how much had I at first? *Ans. \$1200.*
8. How many times does the cube root of 1068462648 contain the square root of $\frac{1}{1778}$? *Ans. 1277 $\frac{1}{2}$.*
9. When gold is at 115, and U. S. 10-40's at 105, what is a \$500 bond worth in gold? *Ans. \$456.52.*
10. Frame and solve a promissory note upon which four partial payments have been made. Also state what is meant by a note being negotiable.

GEOGRAPHY.

1. Define climate, and name five conditions on which it depends.
2. In what direction does the earth rotate diurnally?
3. Name the five largest cities of the U. S. on the Great Lakes.
4. Bound Indiana and name its principal cities.
5. What is the prevailing religion of South America?
6. Locate two noted volcanoes in Europe.
7. What and where are the following; Belgrade, Ladoga, Moselle, Cattagat, Matapan?
8. What is the capital of Persia? Of India? Of Birmah? Of China? Of Japan?
9. Name the principal bodies of water that wash the shores of Africa.
10. To what European power is Australia subject?

SPELLING.

Viscera, guerrilla, crosier, ukase, longevity, meerscham, mnemonic, siren, sirloin, cachination, cautchout, trichia, apocrypha, crustaceous, ichthyology, epaulet, sidereal, czarina, isosceles, fossiliferous.

HISTORY.

1. Why was the name of "Indian" given to the natives of America?
2. What discoveries or explorations were made by the following persons: De Soto? De Leon? Narvaz? Espejo? De Ayllon?
4. What four wars occurred between the French and English colonies?
5. What were the "Mecklenburg Resolutions"?
6. What took place at Greenville in 1795?
7. In whose administration was Ohio admitted? What was the most important event of Monroe's administration?
9. What led to the Mexican war? Name five battles in that war.
10. Give briefly your method of teaching history.

GRAMMAR.

1. Give the signs of all the modes and tenses.
2. Give the principal poetic feet.
3. Give the principal parts of *rise, seethe, chide, cost, rive*.
4. Give the plurals of *focus, apex, caiman, cattle, nebula*.
5. Give examples illustrating the different constructions of the infinitive.
6. Outline the verb.
7. What is a clause, and a phrase? Illustrate.
8. Parse italicized words: *Having fought* the battles of his *adopted* country, *he was considered a loyalist*.
9. What is meant by the analysis of a sentence?
10. Make and analyze a sentence containing a complex element of 3d class.

THEORY AND PRACTICE.

1. What is teaching? What induces you to teach?
2. State briefly your manner of conducting a class exercise in geography.
3. Do you believe in reviews? Why?
4. Give your opinion in regard to the teacher using a text-book in recitation.
5. Name five prominent educators of the past and five of the present age.
6. How do you prevent tardiness? Whispering?
7. State your method of dealing with unruly pupils.
8. State what the Institute fund is and how it is obtained.
9. Do you expect to attend the regular institute this year? Why?

NOTE.—For solutions to most of the problems and answers to nearly all of the questions in the other branches, see back numbers of *Visitor*. There is nothing in lists that can not be found by reference. The first list was used July 4, for 13 applicants one of whom failed. August 1 twenty-six applicants.

Editorial Notes.

In the next issue *Hints to Young Teachers* will be resumed and a few pages of first-class matter can be expected. Our previous effort received much unsolicited praise. Thank you, kind friends.

Will our good friends kindly favor us with the names and address of persons who might subscribe on seeing a sample copy? We allow a liberal commission to agents. Raise a club at your institute.

Only seven queries remain unanswered of the 700 proposed. No magazine of its kind has done so well. Five problems of the 750 are yet unsolved most of which are indeterminate, lacking necessary data. All this speaks well for the erudition of our contributors. Through their labor of love many hearts are quickened and a spirit of earnest research excited. May each continue in this good work.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

396. What King said, "Good faith, if banished from the earth, should find itself in the hearts of Kings"?

Ans.—King John of France, known as John "the Good", was defeated at the battle of Poitiers, in 1356, and taken as a prisoner to London. Weary of his long captivity he offered humiliating terms to be released, even to surrender to England half of France. These terms the States-General refused. He was at length released on a promise to pay 3,000,000 crowns for his ransom, his son being left as a hostage. His son afterward escaped to Paris. John, declaring that "good faith, if banished from the earth, ought to find itself in the heart of kings," went back to London, where he died in 1364. This incident reminds us of the story of Regulus.

H. A. WOOD.

455. If a person has the first move in a game of checkers, is it a mathematical truth that he can win?

Ans.—It is a mathematical certainty that the person who moves first in a game of skill, where chance has nothing to do in deciding the game, has the advantage. Suppose each player to possess equal skill. It will be observed that the one who moves first has an extra move over his antagonist. If the nature of the game gives an advantage to the extra move, then the first can always win, all other things being equal. In the game of chess some have claimed this advantage for the first move. It may be, however, in the nature of the game, that the person who moves second can force a draw, and thus prevent a defeat. This is probably the case in checkers, supposing each has equal skill. Thus if either wins it must be the first player.

H. A. WOOD.

466. Suppose the sun to be cylindrical in form and to extend, say 30° along the eastern horizon, what would be the appearance of a rainbow in the west?

Ans.—In the center the bow would have its usual form and brilliancy, but would gradually expand into a broad fan shape towards the ends, increasing in obscurity, except near the edges. As each position of a circular sun along the 30° would give a perfect rainbow, the colors of the bow of one point would blend into those of another, the different colors thus becoming obscure, or merging into white.

H. A. WOOD.

497. Why do soft burned brick weigh less than hard burned ones?

Ans.—A hard burnt brick has undergone a thorough chemical process into which oxygen was largely combined, thus increasing its weight above a partially oxydized brick.

GALEN.

607. Give the author of the following:

With devotion's visage,
And pious action, we do sugar o'er,
The Devil himself.

Ans.—Shakespeare.

D. W. K. MARTIN.

626. Give a rule for laying out a half mile race course with the usual straight sides and curves.

Ans. First lay off the two straight sides 40 rods, each parallel to each other and 30 rods apart, then at each end midway between the two lines measure back between them $4\frac{3}{8}$ rods, and from these points with a radius $15\frac{5}{8}$ rods sweep the curves at the ends, each will be 40 rods very nearly. For the inner curve and straight take just half these numbers and do the same.

The above is without any established authority so far as I know, but it will give a true result and be proportionate in form.

A. L. FOOTE.

637. Why is a horse-shoe considered lucky? A. N. SYMMES.

Ans. Formerly the horse-shoe was nailed over the door as a protection against witches. From the same superstitious notion, it was considered lucky to pick up a horseshoe. Lord Nelson had one nailed to the mast of his ship, etc. In the Tower of London is a curious suit of armor worn by King Henry VIII (1490 to 1547) which was a present from the Emperor Maximilian I. of Germany (1459-1519) to the English king, on his marriage in 1509 to Katharine of Arragon. Upon it is the congratulatory word "Gluck," a word from the Gothic signifying prosperity. As armors went out of fashion the term was transferred to ordinary metals, and probably to the horse shoe! and the above term probably lengthened by misapprehension or otherwise into the expression *Good-luck*. A. L. F.

Dr. Samuel Willard, a learned gentleman of Chicago, gave the following answer, p. 139, Vol. I., Henkle's *Notes and Queries*: "Priapus was worshipped as protector of gardens, villas, etc. Beside the peculiar image of him, a common symbol was the *Phallus*, an image of the organ of generation. Under the word *Fascinum* Andrew's *Latin Lexicon* tells us that a phallus was hung about the necks of children to guard them against witchcraft. In the magic horse-shoe we have the best priapus of old heathenism." EDITOR.

646. Give an explanation of the magnetic meridian, with hints for surveying old lines, etc. J. W. DEBERY.

Ans. I would suggest that those interested in the magnetic meridian and its use in surveying, should consult some good treatise on magnetism and on theoretical surveying. It is of so wide a nature that what might be said in a few lines would not throw much light upon the subject. W. H.

647. When and by whom was the plan upon which the Centennial was conducted, originated? JOHN KNIESLY.

Ans. As early as 1866, a proposition was made by Prof. John L. Campbell, of Wabash College, that steps should be taken for the proper celebration of the great nation anniversary. About the same time the question of an international exhibition, was agitated by the Hon. John Bigelow, Hon. Morton McMichael, Senator Henry Lane, M. R. Muckle and Gen. Chas. B. Norton. To these men, more than to others perhaps, must be awarded the honor of having originated the Centennial Exposition. D. W. K. MARTIN.

The appropriation bill was signed February 16, 1876, by the president, with the quill of an eagle found near Mount Hope, Oregon. ED. RYNEABSON.

648. In what year were Post Offices first established? S. S. M.

Ans. Post Offices were first established in 1775 by the Second Continental Congress. (See Henry's History, page 122). WARREN LOY.

In 1672 a mail was established between Boston and New York through Hartford. The round trip was to be made once a month. Postage was fourpence for each letter carried less than sixty miles, and twopence for each additional one hundred miles. ED. RYNEABSON.

649. Why is the earth's orbit elliptical? S. A. SMITH.

Ans. The earth moves under the influence of a force of attraction varying inversely as the square of the distance, which by the theory of central forces requires that the attracted body move in an ellipse with the center of force in the focus. WM. HOOVER.

650. Where is the "Gate of Tears"? What was known as the "Scourge of the Ocean"; also the "Kitchen Cabinet"?

Ans. The "Gate of Tears" is a literal translation of the word Babelmandeb, the straits of which name were so called on account of the number of shipwrecks which occur in them.

The "Kitchen Cabinet" was a name given to the Hon. Francis P. Blair and the Hon. Amos Kendall in the United States by the opponents of President Jackson's administration. Blair was editor of "The Globe" and Kendall was was one of the principal contributors to this paper, the organ of the Pres. As it was necessary for Jackson to consult frequently with these men and to avoid observation, they would, when they called upon him, pass through a back door. For this act because of the numerous removals which were made, the Whig party called them this name in derision.

Charles Gibbs and Wansley were known and were truly represented as the "Scourge of the Ocean." They were executed by the U. S. Apr. 31, 1831.

ED. RYNEARSON.

651. What caused the decrease in population on the Sandwich Islands from 400,000, when Capt. Cook discovered, to 60,000 at present?

W. I. DITMER.

Ans.—Capt. James Cook discovered these islands in 1778, while on an exploring expedition to Behrings Strait. He returned to winter in the Sandwich Islands, and one of the ship's boats being stolen by the natives of Hawii, he went ashore with a few of his men to recover it. They met with violent resistance, and on their retreat to the ship, he and four of his men were killed Feb. 14, 1779. Capt. Cook's estimate of the number of inhabitants is correctly stated in query. The marked decrease in the population since then, is likely due to the ravishes of epidemic diseases and emigration on whale ships.

EDITOR.

652. Where is the center of gravity in a floating body? BUB.

Ans.—At the lowest point. This comes under philosophy. WARREN LOY.

653. Whence came the diamonds and precious stones now "lying loose" and a nuisance in the U. S. treasury?

LEWIS BROWN.

Ans.—Their history is largely a matter of tradition. Their value is variously estimated at from \$50,000 to \$100,000. There is a bottle nearly six inches long filled with glistening diamonds, and besides a large number of separate stones. Some of them are set in beautiful gold ornaments. Most of them have been in custody for 45 years. These were sent to Pres. Van Buren in 1839 by the Imaum of Muscat, as a testimonial for some service to that country by his administration. The donor's desire was that Van Buren should wear them, but the Constitution forbids any one connected with the government to accept a present or decoration from any foreign power or potentate. To return them would be an insult, and to dispose of them puzzled the presidential mind. They were finally turned over to the treasury, where they remain unto this day. Other presents have since been sent to government officers by kings and princes who had not read the Constitution, and stowed away in the vault. Several times the matter was brought before Congress, but no action was taken. It would be shabby to sell them and appropriate the proceeds, and it is likely these "gems of purest ray serene" will continue to lie in the vault.

WILLIAM MANN.

654. Note all the late geographical changes in the government, boundaries, capitals, etc., of the various countries in which our textbooks are not correct at present?

ID.

Ans.—This question is very comprehensive. We can note a few only.

Baton Rouge is the capital of Louisiana; Charleston, of West Virginia; Prescott, of Arizona; Helena, of Montana; Bismarck, of Dakota. Itasca Lake is not the source of the Mississippi; it rises in a small lake above Itasca. Patagonia is no longer a division of South America the portion east of the mountains belong to Argentine Republic, and Chili takes the strip along the western coast. The maps may not all be correct for central Europe and Africa, but we can not here define the changes.

EDITOR.

655. Give the origin of the words "Yankee", "Hurrah", "Fools Cap", "Hobson's Choice". A. N. SYMMES.

ANS.—*Yankee*.—See Webster's Unabridged Dictionary. In addition consult Prof. Skeat's great *Etymological Dictionary* in which he quotes the following little classic to illustrate the derivation of this word:

"A grasshopper sat on a sweet-potato vine,
Sweet-potato vine, sweet-potato vine,
A big wild turkey came running up behind
And yanked the poor grasshopper
Off the sweet-potato vine, sweet-potato vine."

He traces its derivation to the verb *to yank*, meaning "to jerk." Yankee, therefore, means quick moving, hence a spry, smart, active, shrewd person.

Hurrah. Timbs derives this word from the Slavonic *hu-raj*, which signifies *to Paradise*. In Fiske's "Manual of Classical Literature," allusion is made to the analogy between our *hurrah*, *huzza* and *halloo* and the exclamations of the Huron Indians, *Hi ha*, *Ho ho*, *Halouet*. The origin of the word is rather obscure.

Foolscap. Worcester's Dictionary says it is derived from the original watermark—a fool's head with cap and bells. But it is also claimed that when Charles II. soon after the Restoration, had occasion to use the government paper on which Cromwell had caused the stamp of the cap of Liberty to be placed, he said, on learning its meaning, "Take it away; I'll have nothing to do with a fool's cap," hence its supposed origin.

Hobson's Choice. Tobias Hobson, a carrier and inn-keeper of Cambridge, England, gave rise to this adage, which means *this or none*. He used to keep hackney horses, which he let out to students at the University, and being well acquainted with them, he suited the horse to the rider, who, upon a dislike, was sure to get this reply, "This or none." The proverb is now used when a man is reduced to his last extremity. EDITOR.

656. Give the author of the words: "The republic has no need of savants?" What circumstance called forth the statement?

ANS.—Lavoisier, the distinguished French physicist of the last century, although one of the most popular citizens, at last gave offense to the party in power, and was a victim of the guillotine in 1794. When the authorities were importuned to save the life of the learned man, the reply was made "The republic has no need of savants." WILLIAM HOOVER.

657. Describe vulcanized Rubber? By whom was India Rubber made known? G. L. S.

ANS.—Vulcanization of india-rubber is a process of hardening it by action of sulphur or a compound of that element. After the actual combination of sulphur with india-rubber it is truly *vulcanized*, and is no longer softened by a moderate heat, a temperature of 160° centigrade scarcely affecting it; nor is it rendered rigid by cold, and the ordinary solvents fail to dissolve it. There are four or five different methods of vulcanizing rubber, one of which is, to immerse the cut-sheet rubber in a bath of melted sulphur (120° C.) a few minutes when it absorbs about $\frac{1}{10}$ of its weight in sulphur; afterwards it being heated to 140°, true combination sets in and *vulcanized* caoutchouc is the result.

The first notice of india-rubber on record was given in the 15th century, by Herrera, who, in the second voyage of Columbus, observed that the inhabitants of Hayti used balls made of the gum of a tree. Torquemada, however, first mentioned (1615) by name the tree yielding it. The first accurate information was furnished in 1736, by La Condamine, who was sent in 1735 by the French Government to measure an arc of the meridian near Quito. EDITOR.

Answered by Ed. Rynearson.

658. What president did not belong to a secret society? Does Cleveland belong to any secret society? B. F. F.

PARTIAL ANSWER.—We can not now give the name of the *one* who never joined any secret organization. Cleveland belongs, and we know that Washington, Jackson, Tyler, Polk, Pierce, Buchanan, Johnson and Garfield have been Freemasons. Who can further enlighten our readers? EDITOR.

659. Locate Aullagus, Aruba, Almagro, and tell what they are.

ANS.—Aullagus is a lake in Bolivia. Amba is an island north of Venezuela. Almagro is a city of New Castile, Spain. ED. RYNEARSON.

661. Why does the moon rise about fifty minutes later every night? D. C. L.

ANS.—Because she moves, on an average, about 13° eastward over the face of the sky, or in her orbit, every twenty-four hours. This is easily understood. EDITOR.

662. What statue is reported to sing at sunrise? Id.

ANS.—The famous Vocal Statue of Memnon was said to greet his mother Auryra every morning at sunrise with a song of praise. It is now in no musical mood. If the statue ever emitted any musical sounds they were probably produced by fine wires, invisible from the ground, stretched across the lap from hand to hand. D. W. K. MARTIN.

663. What is the "Riddle of the Sphinx" and what the answer?

Riddle:—"What animal is it that walks on four legs in the morning, on two at noon, and three at night?"

ANS.—Man, who in his infancy, or morning of life, creeps upon his hands and feet; in his meridian or noon of life, stands erect; and in his old age, or evening of life, leans upon his staff for support. Edipus, a mythological king of Thebes and son of Laius and Jocasta, solved the riddle whereupon the sphinx destroyed herself. D. W. K. MARTIN.

Answered by Ed. Rynearson who refers to Chambers Enc., Article Edipus.

664. How is noon at different cities indicated by a "ball" arrangement at the Observatory, Washington, D. C.? Id.

ANS.—At many observatories, a large ball covered with black cloth of some kind slides vertically in a pole through its center. At the instant of "mean noon," for instance, this ball is made to drop by electrical connection, and those within sight get the true time. The electric telegraph alone signalizes the instant of noon to distant places, allowance being made for difference in longitudes and for the finite velocity of electricity. WM. HOOVER.

The Great Astronomical Clock, or "Electro-Chronograph" at the National Observatory, was invented by Prof. John Locke, of Cincinnati, and is one of the most remarkable instruments in the world. By means of an electrical battery in the building, the movements of this clock can be repeated by telegraph in any city or town in the land to which the wires extend, and it will record the time so accurately, that an astronomer in Portland or New Orleans can tell with exactness the time of day by this clock. It also regulates the time for the city. There is a flag-staff on top of the dome, upon which a large black ball is hoisted at ten minutes before noon every day. This is to warn persons desiring to know the exact time, to examine the watches and clocks. Just as the clock records the hour of twelve, the ball drops, and thus informs the city that it is high noon. JNO. KNIESLY.

665. Give the origin and meaning of the term *mugwump* as used in political parlance. N. A. G.

Ans.—Between the tadpole state and that of frog is a time when the animal is called a “mugwump,” and this has been given as the origin of *mugwump*.

R. J. TOTTEN.

The creature is neither one nor the other during the transitional period referred to by Mr. Totten; hence the present application of the word *mugwump* would seem to favor this idea of its origin. There are different opinions as to its origin. The *New York Sun* is said to have first applied the term to the Republican bolters at the last presidential election. We can not refrain from giving the *Boston Courier's* poetry, published of late.

The bugwump comes when the hour is late
To the pane where the light is shining,
And the hugwump stands at the garden gate;
His arm the maid entwining.

The drugwump waits for the stealthy wink
The brand denominating,
And the jugwump gayly takes a drink
From his jug while his hook he's baiting.

The pugwump kisses the nose of her pet,
And folds him to her bosom,
And the mugwump waits for his office yet,
And—well, we must excuse him.

If this disposition of the query does not satisfy, please give us more light on the subject.

EDITOR.

666. Give the boundaries of the different oceans, where they form one common body of water.

Id.

Ans.—Arctic circle bounds the Arctic ocean; Antarctic circle, the Antarctic ocean. The meridians passing through Cape Horn, Cape of Good Hope, and the southern point of Tasmania, are respectively the boundaries of the Atlantic, Indian and Pacific oceans.

EDITOR.

667. Describe the largest telescope in the world.

Id.

Ans.—The *Scientific American* of April 4, says: The great Russian telescope at Pulkowa, a refractor of 30 inches aperture, finished in 1882, now enjoys the distinction of being the greatest refractor in the world. Clark & Son, of Cambridgeport, Mass., made the object glass for this huge instrument, at a cost of about \$12,000, the mounting being the work of Repsold & Sons, Hamburg, Germany. The Russian telescope will not long enjoy the supremacy. The Messrs. Clark are now in process of making a refractor for the Lick Observatory on Mt. Hamilton, California, with an aperture of 36 inches, which will, when finished, take the first rank in size and probably in cost. The reflecting telescope of the Earl of Rosse, in Parsonstown, Ireland, takes the lead in size among reflectors. It cost \$250,000. The speculum, or mirror, is 6 feet in diameter, weighing 4 tons, and the focal length is about 54 feet. EDITOR.

Answered by T. A. Hughes, *New Madison, Ohio*.

668. Please explain what is meant by a printer's “square” in measuring advertising matter.

UNO.

Ans.—The law of Ohio estimates 240 ems of the type used as a square. An em is standard measure, and has no reference to the letter *m*. It takes 6 ems pica to make a line one inch long, or 36 ems in a square inch. The standard newspaper column is 13 pica or $2\frac{1}{4}$ in. wide, and nonpareil ($\frac{1}{2}$ pica) making 26 ems to the line, a square would require $240 \div 26$, or about 14 lines. The type used for this answer is brevier, and 9 ems make an inch, each line is 4 in. or 36 ems long, and a square would take $240 \div 36 = 7$ lines, fractions disregarded. The query is primer of which $28\frac{1}{2}$ ems make a line, and $240 \div 28\frac{1}{2} = 9$ lines make a square, or exactly 3 squares in 25 lines.

EDITOR.

QUERIES.

700. Describe the Sirenia or Sea Cows, and tell where they are found. L. B.

701. Give a sketch of the author of "Rock Me to Sleep, Mother. Id.

702. What was the "Battle of the Spurs? The "Second Battle of the Spurs"? The "Battle of the Brothers"? Why so called?

H. A. WOOD.

703. Who founded the University of Paris? The Royal Library of Paris? Id.

704. What was the "Day of the Herrings"? The "Treaty of the Merchants"? The "Ladies Peace"? Id.

705. Fortune, like the rest of her sex, favors the young and neglects the old," were the words of what emperor? Id.

706. Why is water solidified (ice) able to float on water? Id.

707. From what height must a block of ice fall that the heat generated by the collision may be just able to melt it? Id.

708. Determine the velocity with which a lead ball must strike a target that the heat generated by the concussion may be sufficient to fuse it? Id.

709. Some ants have wings; do such ants fly? JNO. GOTTSCHALL.

710. Give the origin of Thanksgiving. HATTIE HARPER.

711. Give date and particulars when an attacking party retreated on account of fire flies. ED. RYNEARSON.

712. Locate and describe "The Boiling Mountain". Id.

713. About how many octaves does the whole range of human hearing, from the lowest note of the organ to the highest known cry of insects, include? D. W. K.

714. What were Stonewall Jackson's last words? Id.

715. Is the "British Lion" a myth, or did the lion ever live in England? L. M. O.

716. What is the "Curfew Law," and who originated it? Id.

717. Why is the capital of Holland called "The Hague"? Give origin of the name of Brandywine creek, the scene of a Revolutionary battle. Id.

718. Are the historical works of Eusebius, Justian Martyr, Tertulian, Mosheim, and Ambras still in existence? Give sketches of these authors. J. W. DEBERY.

719. Name the first ten Popes, giving the date of their induction, and the three deposed by Henry III. with reasons for so doing. Id.

720. Note and describe the natural wonder on the island of Trinidad. U. S.

Answers should be received on or before Sept. 1.



EDITED BY

JOHN S. ROYER.

VOL. VI.

SEPTEMBER, 1885.

No. 9.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

755. By L. B. FRAKER, *Pettisville, Ohio*.—"The vertical angle of a triangle is given in magnitude, and the vertex of the triangle is in the circumference of a circle given in magnitude and position; also, the base of the triangle is in a straight line given in position, and one extremity of the base is given in position. It is required to determine the triangle when the base is a minimum."-

Remarks by the Editor.

This difficult prize-problem is solved in *Hallowell's Geometrical Analysis*, pp. 178-9. This excellent work is published by J. B. Lipincott & Co., Phil'a. Our contributors made no numerical application, and we refer those interested to the book for the analysis and a fine demonstration.

756. By H. A. WOOD.—Given $xy=300x+125y$ and $x^2-y^2=90000$. Find x and y by brief process.

By J. H. DRUMMOND, Portland, Me.

This is an old acquaintance of mine, a friend of my youth, but I know of no briefer process than the following:

Instead of x and y , take $100x$ and $100y$; then we have

$$4xy=12x+5y \dots (1), \text{ and } x^2-y^2=9 \dots (2).$$

From (1), $y=12x \div (4x-5)$. Substituting this in (2), we obtain

$$x^2 - \frac{144x^2}{(4x-5)^2} = 9,$$

$$\text{Or } (4x^2-5x)^2 - 144x^2 = 9(16x^2-40x)+225,$$

$$\text{Or } (4x^2-5x)^2 - 9(32x^2-40x) [=72(4x^2-5x)] = 225,$$

Whence $4x^2-5x=56 \pm 39=75$ (the only value); $\therefore x=5$ and $y=4$. So the numbers are 500 and 400, respectively.

Solved by L. A. REED, A. L. FOOTE, and the PROPOSER.

757. By ROBT. J. TOTTEK, *New Wilmington, Pa.*—Two towers, AB and CD , of different height, are perpendicular to a horizontal plane. It is required to find the heights of the towers and the distance between them if the line from the top of the higher, AB , to the bottom of the lower be 100 ft., the line from the top of the lower to the bottom of the higher, 80 ft., and their point of intersection be 20 feet from the ground.

By D. H. DAVISON, *Minonk, Ill.*

Put $AD=a=100$ ft., $BC=b=80$ ft., $EF=c=20$ ft., E being point of intersection of diagonal lines, and F , point on ground directly under intersection: G and H , being points respectively on higher and lower towers, each 20 ft. from the ground. Let $x=DE$, then $a-x=AE$; $\sqrt{(x^2-c^2)}=EH$. . . (1); by similar triangles $DE : EH :: AE : EG$, $\therefore x : \sqrt{(x^2-c^2)} :: a-x : [(a-x) \div x] \sqrt{(x^2-a^2)} = EG$. . . (2). $\sqrt{(EG^2+BG^2)}=BE$, hence $\sqrt{\{[(a-x) \div x]^2(x^2-c^2)+c^2\}}$, or $\frac{1}{x} \sqrt{(x^4-2ax^3+a^2x^2+2ac^2x-a^2c^2)}=BE$.

By similar triangles, $AE : BE :: DE : CE$, or $(DE \div AE) \times BE = CE$ $\therefore [1 \div (a-x)] \sqrt{(x^4-2ax^3+a^2x^2+2ac^2x-a^2c^2)} = CE$; $BE+CE=b$, or $[a \div (a-x)] \sqrt{(x^4-2ax^3+a^2x^2+2ac^2x-a^2c^2)} = b$.

Cleared, squared and reduced, we have

$$x^4-2ax^3+a^2x^2+\frac{2a^3c^2}{a^2-b^2}x=\frac{a^4c^2}{a^2-b^2}$$

Restoring values of a , b , c , and we have

$$x^4-200x^3+10000x^2+22222\frac{2}{9}x=1111111\frac{1}{9},$$

From which $x=30.0883209$ ft.; from (1), find $EH=22.479036$ feet, and from (2) find $EG=52.231135$ feet; the sum of these two terms gives $BD=74.710171$ feet, distance between towers; this being the base of a right triangle whose hypotenuse is 100 feet, we find its perpendicular side is 66.470973 feet, height of higher tower; taking other diagonal 80 feet, we find 28.6075228 feet, height of lower.

Fine solutions by MESSRS. WOOD, DRUMMOND, WILEY, RUSSELL, FOOTE, GREGG,

758. By G. H. HARVILL, *Ada, La.*—Required the length of the diagonal of a cube, the length of whose side is s .

By COOPER D. SCHMITT, *Charlottesville, Va.*

If s be the length of one side then the square of the length of the diagonal of that side will be $s^2+s^2=2s^2$. To find the diagonal of the cube we will have to find the hypotenuse of a right angled triangle in which the diagonal just found will be the base and the length of a side of the cube the altitude. Hence we will have for the square of the diagonal of the cube $2s^2+s^2=3s^2$, and the diagonal is $\sqrt{3s^2}=s\sqrt{3}$.

Solved by GEO. C. RUSSELL, D. W. K. MARTIN, A. L. FOOTE, WM. WILEY, J. H. DRUMMOND, and the PROPOSER.

759. By C. T. YOUNG, *Weaversville, Pa.*—A broker sold 6% stock at 105, and invested the net proceeds for the owner in another 6% stock at 103, brokerage $\frac{1}{2}\%$ on each transaction; what rate does the investment pay?

By HARRY DERSHEM, *Gettysburg, Ohio.*

Let the par value of one share of the first stock be \$100, which the broker sells for \$105. Brokerage being $\frac{1}{2}\%$ on the par value, leaves \$104 $\frac{1}{2}$ net proceeds. Let 100% represent the par value of second stock; then one share of first stock will pay for $\$104\frac{1}{2} \div 1.03\frac{1}{2} = \$100\frac{2}{3}\frac{0}{7}$ worth (par value) of second stock. The owner's income on this is $\$100\frac{2}{3}\frac{0}{7} \times .06 = \$6\frac{1}{3}\frac{0}{7}$; hence the investment pays $6\frac{1}{3}\frac{0}{7} \times 100 \div 105 = 51\frac{1}{4}\frac{5}{9}\%$.

Solved by D. W. K. MARTIN, H. A. WOOD, J. H. DRUMMOND and J. C. GREGG.

760. By C. T. YOUNG.—O is a fixed point from which any straight line is drawn meeting the circumference of a fixed circle at P; in OP a point Q is taken such that OQ is to OP in a fixed ratio. Determine the locus of Q.

By J. C. GREGG, *Brazil, Ind.*

Let O be the fixed point, OP the variable line, and C the center of given circle. Divide OC so that $OD : OC :: OQ : OP$, and join DQ and CP. Then with D as a center and radius DQ, draw a circle and it will be the locus of Q.



Because CP is invariable, DQ will be invariable, and Q will describe a circumference about the center D.

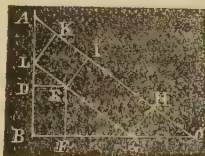
A. L. FOOTE and FEO. C. RUSSELL solved it.

761. By B. F. FINKEL, *Ada, Ohio.*—A field in the form of a right triangle has a tree in it; the nearest distance from the tree to the fences are 8, 10 and 12 rods respectively. Determine the area of field.

By A. L. FOOTE, *Hempstead, N. Y.*

The above problem is not properly limited since the same data may give rise to an infinite number of answers. The following is offered.

Let E be the position of the tree. Construct the rectangle EFB D, so that BD or FE=12 and BF or DE=10. Produce BF indefinitely; also BD. In BF produced take FG=16 (but any other value would do as well), from G through E draw the straight line intersecting BD produced in L; at E lay off EI=8 at right angles to LG, and through I draw a straight line parallel to LG, intersecting BG and BL pro-



duced in the points C and A . Then will the triangle ABC fulfil the conditions required.

Draw LK and GH parallel to EI . By similar triangles LDE and EFG , we have $EF : FG :: LD : DE$, or $12 : 16 :: LD : 10$; $\therefore LD = 7\frac{1}{2}$; and in like manner $LE = 12\frac{1}{2}$ and $EG = 20$. From the similar triangles EFG and GHC , we have $EF : FG :: GH : HC$, or $12 : 16 :: 8 : 10\frac{2}{3} = HC$; and in like manner $GC = 13\frac{1}{3}$. From the similar triangles LDE and LKA , we show in like manner $AK = 6$ and $AL = 10$. Now for the area we have $AB = 10 + 7\frac{1}{2} + 12 = 29\frac{1}{2}$ and $BC = 10 + 16 + 13\frac{1}{3} = 39\frac{1}{3}$, so $(39\frac{1}{3} \times 29\frac{1}{2}) \div 2 = 580\frac{1}{6}$ sq. rds.

Solved by MESSRS. WOOD, WILEY, GREGG, DRUMMOND, RUSSELL.

762. By N. R. OLIVER, *Dorchester, Ontario*.—Given the quadrant of a circle containing an acre of land; required the length of a line perpendicular to the side and terminating in the curve that will divide it into two equal parts, without the application of Algebra?

By PROF. H. WOOD, *204 East 51st St., New York*.

In problem 751 (p. 139, *August Visitor*), it was ascertained by the aid of Trigonometry, that the required line must be drawn $.403974r$ from the center. The area of a circle $= \pi r^2$; area of the quadrant is $\frac{1}{4} \pi r^2 = 160$ sq. rds. Whence $r = 14.27$ rds., nearly, and $14.273 \times .403974 = 5.7659$ + rds., distance of the line from the center. The length of the required line then is $(14.27^2 - 5.7659^2)^{\frac{1}{2}} = 13.05$ + rods.

Solved by A. L. FOOTE, A. M. SCRIPTURE and R. A. LEISY.

763. By L. A. REED, *Cleveland, Ohio*.—A cubical block of wood just sinks into the water half-way and supports a weight of n pounds. If this block be divided into m boards, each of equal thickness, what will be the total amount supported by all these boards, when each just sinks half-way into the water?

By WM. WILEY, *Detroit, Mich.*

Let W be the weight of the block. If n be removed, the portion submerged is $\frac{1}{2}W - n$, and the specific gravity is $(\frac{1}{2}W - n) \div W$. $\therefore W(\text{sp. gr.}) = \frac{1}{2}W - n$, and $n = \frac{1}{2}W - W(\text{sp. gr.}) = W(\frac{1}{2} - \text{sp. gr.})$. The value of the second member of this equation is the same, whether the block is cubical or divided into m boards placed along side on the water, all the factors being the same and the depth uniform in each case. Therefore, n is the quantity required.

Or, by more strict analysis. Let x be required to sink a board $(W \div m)$ to the required depth. Then since the weight of the board is $(W \div m) \times x = (W \div m)(\frac{1}{2} - \text{sp. gr.})$, and mx , or the whole weight required is $W(\frac{1}{2} - \text{sp. gr.}) = n$, which is the quantity called for.

764. *By Request.*—Two pendulums make 24 beats in 26" and 36 beats in 40", respectively; if they start together, when first will the beats occur together?

By D. W. K. MARTIN, Webster, Ohio.

The first makes one beat in $\frac{26}{24}"$ and the second in $\frac{40}{36}"$. Hence, if they are started together, to find when they will again beat together we simply get the L. C. M. of $\frac{26}{24}$ and $\frac{40}{36}$, which is $43\frac{1}{3}$, the number of seconds required.

By GEO. C. RUSSELL, San Francisco, Cal.

They will first beat together when one beat is gained. The first makes $24 \div 26 = \frac{12}{13}$ of a beat per second; hence $\frac{12}{13} - \frac{1}{10} = \frac{3}{130}$ of a beat is gained in a second, and $1 \div \frac{3}{130} = 43\frac{1}{3}$ seconds is the required time, in which the first makes 40 beats and the second 39 beats.

MESSRS. GREGG, SCHMITT, FOOTE, WILEY and WOOD solved it.

765. *By LIBRA.*—A New York merchant, having £350 to pay in London, bought a draft for that amount with gold at 114, exchange standing at \$4.85. He might instead have remitted 5-20's, then selling at $119\frac{1}{2}$ in New York, and worth $107\frac{3}{4}$ in London. Would he have gained or lost by so doing, and how much?

HON. J. H. DRUMMOND, Portland, Me.

In one case it takes 114 to pay 100, and in the other $119\frac{1}{2}$ to pay $107\frac{3}{4}$ or $110\frac{390}{431}$ to pay 100. Hence by adopting the second method, he would save $114 - 110\frac{390}{431} = 3\frac{41}{431}$ on every hundred that he pays. He would save in all $.03\frac{41}{431} \times 350 \times 4.85 = \52.54 .

Solved by MESSRS. RUSSELL, FOOTE, SCHMITT, SHANER and LEISY.

766. *By LIBRA.*—A merchant bought 5600 bu. of wheat and sold $\frac{1}{5}$ of it at a profit of 5%, $\frac{1}{4}$ of it at a profit of 7%, and the remainder at a profit of 12%. Had he sold all at a profit of 9%, his gain would have been \$24.50 less; what did the wheat cost him per bu?

By J. C. CORBIN, Little Rock, Ark.

Selling $\frac{1}{5}$ at a profit of 5% gives 1% profit on the whole cost; 7% on $\frac{1}{4}$ of it, gives $1\frac{3}{4}\%$ on whole cost; and 12% on the remainder $\frac{1}{2}\frac{1}{5}$, is the same as $6\frac{3}{5}\%$ profit on whole cost; hence he sold all at rates equivalent to $1\% + 1\frac{3}{4}\% + 6\frac{3}{5}\% = 9\frac{7}{10}\%$; from the second condition $\frac{7}{10}\% = \$24.50$, or whole cost is $\$24.50 \div .00\frac{7}{10} = \7000 . The price per bushel is $\$7000 \div 5600 = \1.25 .

Solved by MARTIN, SCHMITT, RUSSELL, GREGG, FOOTE, LEISY, DRUMMOND and WOOD.

767. *By A. H. STANHOPE, North Bradford, Me.*—A lady has two silver cups, and but one cover for both; the cover weighs 10 ounces; now, if the cover be put on the first cup, it will make the weight double that of the second, and if the cover be put on the second, it will make the weight triple that of the first; what is the weight of each?—*Greenleaf.*

By A. M. SCRIPTURE, *Clinton, N. Y.*

Let x = smaller cup

y = larger cup

Then $x + 10 = 2y = x - 2y = -10$

$3x = y + 10 = 3x - y = 10$

Whence $x = 6$ and $y = 8$.

Solved algebraically by MESSRS. RUSSELL, MARTIN, CORBIN, LEISY, DRUMMOND, SCHMITT, WOOD, FOOTE, WILEY.

By A. H. STANHOPE, *North Bradford, Me.*

Once weight of 1st cup and 10 oz. is twice weight of 2d cup,
 3 times weight of 1st cup is once weight of 2d cup & 10 oz.
 4 times weight of 1st cup and 10 oz. is $3 \times$ weight of 2d cup & 10 oz.
 4 times weight of 1st cup is 3 times the weight of 2d cup.

Once weight of 1st cup is $\frac{3}{4}$ the weight of sec. cup.

Now, as once the weight of first cup and 10 ounces is twice the weight of 2d cup, and as once the weight of 1st cup is $\frac{3}{4}$ the weight of 2d cup, then $\frac{3}{4}$ the weight of 2d. cup and 10 oz. is (twice) or $\frac{3}{2}$ the weight of 2d cup. 10 oz. is $\frac{5}{4}$ the weight of 2d cup; 8 oz. is the weight of 2d cup. The 1st cup is $\frac{3}{4}$ the weight of 2d cup, or 6 oz.

Solved by MESSRS. GREGG, SHANER and FOOTE.

768. By D. H. DAVISON, *Minonk, Ill.*—After placing four balls of equal size in a compact triangular pile, one of the base balls rolled from the other two, resting equidistant from each, being 2 inches distant from their point of contact; the top ball resting on the three base balls, being 3 inches above the plane on which they rested. Required height of the pile in last-mentioned position.

By the PROPOSER.

To make the solution general.

Let d = diameter of a ball. Let w = distance from point of contact of the two contiguous base balls to center of the detached ball, being the length of base of tetrahedron formed by connecting centers of three bottom balls to center of the top ball. Let h = perpendicular height of tetrahedron. Let n = distance from point of contact of the two contiguous base balls to nearest surface of the detached ball. Let H = height of pile. Let W = length of pile.

We now have six terms, two of which being given, either of the other four can be found, giving rise to sixty distinct propositions.

The distance from center of top ball to point of contact of the two contiguous base balls, being the distance from one angle to the middle of the opposite side of the equilateral triangle each of which = d , is $\sqrt{(d^2 - \frac{1}{4}d^2)}$ or $\sqrt{(\frac{3}{4}d^2)}$.

The distance from point of contact of the two contiguous base balls to a point in the plane of the tetrahedron directly under its apex, is $\sqrt{\frac{3}{4}d^2 - h^2}$.

The distance from point in plane of base of tetrahedron directly under its apex, to center of one of the contiguous base balls,

$$\sqrt{\frac{3}{4}d^2 - h^2 + \frac{1}{4}d^2} \text{ or } \sqrt{d^2 - h^2}.$$

The distance from point in plane of base of tetrahedron directly under its apex to surface of one of the contiguous base balls, being same distance to surface of the detached base ball is $\sqrt{d^2 - h^2} - \frac{1}{2}d$. Combining results we have $n = \sqrt{\frac{3}{4}d^2 - h^2} + \sqrt{d^2 - h^2} - \frac{1}{2}d$.

From this formula we find n , when d and h are given. And we find d , in terms of p , and n , as follows: Transpose terms and multiply by 2, gives $2n + d - 2\sqrt{d^2 - h^2} = 2\sqrt{\frac{3}{4}d^2 - h^2}$. Squaring, etc., we have $(8n + 4d)\sqrt{d^2 - h^2} = 4n^2 + 4nd + 2d^2$. Squaring each member, condensing, arranging, uniting terms, and dividing by 4, we get the formula $3d^4 + 12nd^3 + 4(2n^2 - h^2)d^2 - 8n(2h^2 + n^2)d = 4n^2(4h^2 + n^2)$.

As $H = h + d$; also by conditions of the question $H = 3 + d$; it follows that $h = 3$. Substituting this value of h , also value of $n = 2$ in the general formula it becomes $3d^4 + 24d^3 - 4d^2 - 352d = 640$. When balls are piled in compact from $d = n(\sqrt{3} + 1)$. When detached ball is rolled to its extreme limit $d = n(\sqrt{3} - 1)$. Putting value of $n = 2$ in these limiting formulas we find d must be between 5.404 and 1.464. Hence, although the resulting equation gives four values of d yet it contains but one root that will satisfy the conditions of the problem. By the general rule for the numerical solution of higher equations we readily find $d = 3.8636840104$, hence $H = 6.8636840104$ inches.

WM. WILEY gave an excellent solution. Also solved by A. L. FOOTE and D. W. K. MARTIN.

769. By A. W. MASON, Cedar Falls, Iowa.—A hemispherical bowl ACB contains a weight W which is attached to a weight P by means of a string passing over the rim of the bowl at the point A . Determine W 's position of equilibrium.

By PROF. WILLIAM HOOVER, Athens, Ohio.

Let 2ψ = the angle subtended at the center of the bowl by the part of the string within the bowl. The system is in equilibrium by the action of the weight W acting vertically downwards, the tension $T = P$ in the direction of the chord subtending 2ψ , and the reaction R of W and the bowl in the direction of the radius through the position of W . Resolving parallel to the tangent through W ; $W\cos 2\psi = T\cos\psi = P\cos\psi$, whence $\cos\psi = (P \pm \sqrt{P^2 + 8W^2}) \div 4W$, which determines the position of W . If the radius of the bowl were infinite, $\psi = 0$, and then $P = W$, as it should be.

Solved by WM. WILEY and PROPOSER.

Problems for Solution.

779. *By* WARREN LOY, *Pyrmont, Ohio*.—If 7 is $\frac{1}{2}$ of 20, what is $\frac{7}{8}$ of 39?

780. *By* A. M. SCRIPTURE, *Clinton, N. Y.*—Two fields, one square and the other circular, are enclosed by board fences. The boards are 11 ft. long, (bent to the form of the circular field,) and 4 boards to the length. There are as many acres in each field as there are boards in the fence. How many acres in each field?

781. *By* H. A. WOOD, *New York City*.—If a man had bought his horse for 20% less and sold it for the same as he now sells it for, he would have gained 30% more. What per cent does he gain?

782. *By the same*.—If an article had cost me 10% less my rate of gain would have been 11% more. Required, my rate of gain or loss.

783. *By the same*.—A man stole £19 19s. 11d. 3far., for which he was sentenced to pay £19 19s. 11d. 3far. for every pound stolen; how much did he pay?

784. *By* G. L. SHANER, *Stewart's, Pa.*—The frustum of a pyramid has a slant height of 40 feet, a top 15 feet square and a base 50 feet square. By how much does the entire surface exceed that of the frustum of a cone, slant height 3 yards, radii of bases 6 feet and 6 inches, respectively. *Spiegel's Live Questions*.

785. *By Request*.—A can buy a house for \$6,000 cash, or equal installments of \$1,200 a year for 6 years; which is better for A, money being worth 6%?

786. A fountain has 4 receiving pipes, A, B, C, and D; A, B, and C will fill it in 6 hours, B, C, and D in 8 hours, C, D, and A in 10 hours, and D, A, and B in 12 hours; it has also 4 discharging pipes, W, X, Y, and Z; W, X, and Y will empty it in 6 hours, X, Y, and Z in 5 hours, Y, Z, and W, in 4 hours, and Z, W, and X in 3 hours; suppose the pipes all open, and the fountain full, in what time would it be emptied?

787. A merchant bought 400 yards of cloth at \$4 per yard, payable in 6 months, and immediately sold it at \$4.10, giving a credit of 3 months, at the expiration of which term he anticipated the payment of his own paper, getting a discount off of 10% per annum. What did he gain by the transaction?

788. A merchant bought 400 yards of cloth at \$4 per yard, payable in 3 months, and after holding it for 15 days sold it at \$4.25 per yard, receiving therefore a note payable in 4 months. When the purchase money became due, he had this note discounted at the bank to meet it. What did he gain by the transaction?

789. Taking the conditions of the last example, what would he have gained if he had borrowed at 6% interest, until the maturity of the note he had received, sufficient to pay for the cloth; and why should there be any difference in the results?

790. What length must be cut from the narrow end of a board to contain a square foot, the length of the board being 6 feet, its width at one end 12 in. and at the other 8 inches?

791. A, B, C, D, purchase a farm for \$9,000. The purchase money is \$1500 more than A, B, and C, are worth, \$200 more than B, C, and D, are worth, \$700 more than C, D, and A, are worth and \$1200 more than A, B, and D, are worth. How much money has each?

792. A metallic cylinder, 20 inches long, and 2 inches in diameter, is closed at each end by a hemisphere; if the whole solid is converted, without loss, into a sphere, what is its diameter?

793. Two trains, one 210 feet and the other 230 feet long move on parallel tracks. When going in the same direction they pass each other in 15 seconds, and when going in opposite directions they pass in $3\frac{3}{4}$ seconds. How many miles an hour were they moving?

794. At what time between 10 and 11 o'clock do the hour and minute hands make equal angles with a line from XII. to VI.?

795. A square prism of solid glass 9 inches long was dropped into a cubic vessel containing 6 gal. 3 qt. $3\frac{1}{2}$ gi. of water, and the water, and the water came to the brim. Find the thickness of the glass, if the capacity of the vessel was one cubic foot.

796. A conical cork whose slant height is 5 inches and diameter of base 6 inches floats on water with vertex downward. If its specific gravity is .125, how many inches of its axis will be under water?

797. In turning a cart within a circle it was observed that the outer wheel made three turns while the inner made but two; the wheels were each 3 feet high, and the tracks $4\frac{1}{2}$ feet apart. Required, the length of the outer track.

798. A merchant in Cincinnati wishes to pay a debt of \$1400 in San Francisco. The time discount being 5% and exchange $\frac{1}{8}\%$ premium, what must he pay for a 60-day draft?

799. I wish to line the carpet of a floor whose area is $34\frac{5}{8}$ sq. yd., and whose length is to its breadth as 38 to 33, with muslin $\frac{3}{8}$ of a yard wide; how many yards of muslin must I buy, if it will shrink 4% in length and 5% in width?

800. A Boston merchant remitted to Cleveland a draft for \$1250, at 90 days, at 6%, paying for it \$1221.25; what was the rate of exchange?

NOTE.—The last fifteen problems are by request, and the whole list is published in honor of a demand from practical teachers for elementary work; such as will stimulate themselves and their pupils in the acquisition of mathematical skill. Our contributors will please notice that the *Visitor* furnishes supplementary work in mathematics for nearly a thousand common school teachers, and difficult arithmetical problems are, therefore, very highly appreciated. College professors, school examiners, county superintendents and private students use them. Those interested in this work will please forward problems containing difficulties in arithmetical analysis, and we shall honor all requests. Our esteemed friend J. B. Sanders, of Cambridge City, Ind., sent Nos. 787-8-9, and desires a brief discussion on the point italicized in No. 789. We trust a large number of our friends will be sufficiently interested to send us carefully prepared solutions of the whole list. We shall devote a page or two of the November issue to brief notices of the contributors who solve *all* the problems. Can we not fill two pages with names, addresses, avocation, titles, etc. of those who may furnish the 22 solutions? You can write on light paper but on one side only. Put your name to each solution, No. the solution to correspond with the problem. You need not copy problem. Solutions should reach us on or before Oct. 10.

Editorial Notes.

After a year's illness, Artemas Martin is able to attend to his duties again. We are glad to note this, and to announce that his *Visitor* and *Magazine* will be resumed. He has lately received additional honors, for it is now Artemas Martin, M. A., Ph. D., LL. D., member of the London Mathematical Society, of the Edinburg Mathematical Society, and of the Mathematical Society of France.

Marcellus M. Thompson lately received a golded-headed cane, as a prize.—*Clarksburg* (W. Va.) *News*.

P. H. Philbrick, Prof. of Engineering in State University, Iowa City, will please accept our thanks for copy of his *General Discussion of Wind Pressure upon Spherical, Cylindrical and Conical Surfaces*, published in "Van Nostrand's Engineering Magazine."

We desire to call the attention of our readers to the practical character of of the solutions in this number, and the valuable information contained in the miscellaneous department.

We have no satisfactory answers to queries 704-5-15 17-19. Answers solicited to these, which should be received before the 20th.

Examination Questions.

Sept. 5.

GRAMMAR.

1. How do we determine the part of speech to which a word belongs?

ANS.—By the office or function it performs in the sentence.

2. What is meant by the properties of a part of speech?

ANS.—That which belongs to it in the exercise of its function.

3. What is the sign of the infinitive, when to is omitted, and in what cases may the infinitive as a noun be used?

ANS.—Its sign is not expressed after the words *bid, dare, make, see, hear, feel, help, let, etc.* In any case except the possessive.

4. Give the plural of *cargo, folio, witness, beef*, and rule for each.

ANS.—*Cargoes* and *folios*, because when final *o* is preceded by a consonant, *es* is added, and preceded by a vowel, *s* only. But there are exceptions in *o* to this rule; as, *canto, grotto, halo, memento, octavo, solo, tyro, etc.*, take *s* only. *Witnesses*, because nouns ending in *s* take *es* to form the plural. *Beeves*, in which *ves* is taken for *f*.

5. Define elements of the first, second, and third class.

ANS.—Respectively whose bases are *one word, two words, and a sentence.*

6. State the kind of elements introduced by a relative pronoun. A conjunctive adverb.

ANS.—Adjective. Adverbial.

7. Illustrate by examples the use of nouns in the absolute case.

ANS.—Pleonasm, direct address, with a participle, by exclamation, and by inscription. Examples—The *canary*, who killed it? *Hero*, arise. The *enemy* having gone, we advanced. O, *Jerusalem!* The home of the prophets. *John Brown*, Halifax, N. S.

8. Give an example of an abridged proposition.

ANS.—I wished him to go = I wished that he should go.

9. Parse italicized words: The lake is five *feet deep*. The hat *is worth a dollar*. I heard the *bird singing* in the trees. That book of *yours* is torn.

ANS.—*Feet* is a common noun, of the neuter gender, third person, plural number, and in the objective case, without a governing word.

Deep is a common, descriptive adjective, in the predicate with *is*, and refers to the subject *lake*.

Is is copulative verb, in the indicative mode, present tense, third person and singular number, to agree with its subject *hat*.

Worth, same parsing as *deep*.

Dollar, same as *feet*.

Bird is a common noun, of the neuter gender, third person, singular number, and in the objective case; it is the object of *heard*.

Singing is a present participle; it has the construction of an adjective, limiting *bird*.

Yours is a possessive pronoun, object of the preposition *of*.

10. Analyze: From an eminence which commanded a view of the Mexican capital, the *American* chieftain beheld his country's flag, *erected* by the vanguard of the army, *floating* above the palaces of the Montezumas.

{	chieftain	the												
		American												
{	beheld	from eminence	{	an	{	which	commanded	view	a					
{	flag	country's	{	his	{	the	of capital	{	the					
		erected		by vanguard		of army		the						
		floating		above palaces		the		of Montezumas						
								the						

American is an adjective, and *erected* and *floating* are participles.

ORTHOGRAPHY.

1. Define and give examples of simple, compound, primitive and derivative words.

ANS.—A simple word is one which is not composed of two or more whole words; as, *gold*, *silver*.

A compound word is composed of two or more distinct words; as, *schoolmaster*, *silver-smith*.

A primitive word can be reduced to no fewer letters than it has, without changing its signification; as, *fair*, *repent*.

A derivative word is formed from a primitive generally by the addition of prefixes or suffixes; as, *unfair*, *repentance*.

2. Name the organs of speech.

ANS.—The lips, teeth, tongue, palate and glottis.

3. What is meant by the power of a letter?

ANS.—Its elementary sound.

4. What is an alphabet?

ANS.—A list or series of symbols which represent conventionally to the eye the sounds heard in the speech of a nation.

5. State the distinction between a letter and an elementary sound.

ANS.—A letter is the character which represents the elementary sound.

6. How is the number of syllables in a word determined?

ANS.—By the number of vowels or diphthongs that are sounded.

7. Define primary and secondary accent, and state which syllable in *orthography* receives the primary accent.

ANS.—Primary is the principal, and secondary the partial, accent. The second syllable gets the primary accent in *orthography*.

8. What are substitutes? Name the substitutes in *chronometer*, *physiology*, and *tyrannical*.

ANS.—A substitute is a letter representing the sound that another letter usually represents, and assuming all its properties. We may say that *ch* is a substitute for *k*, *ph* for *f*, and *c* for *k*.

9. State the use of the diæresis; of the caret.

ANS.—The *diæresis* is placed over one of two vowels, separating them into two syllable. The *caret* indicates the omission of a word or letter.

10. Name all the vowels.

ANS.—The vowels are *a*, *e*, *i*, *o*, *u*; semivowels, *w* and *y*.

ARITHMETIC.

1. How many cubic inches in 24 gallons, 3 quarts, 1 pint, $2\frac{1}{2}$ gills of water?

Ans.—By reduction we get 24.953125 gal.; $24.953125 \times 231 = 5764.171875$ cu. in.

2. Six men can do a piece of work in $4\frac{1}{3}$ days; after working two days, how many men must join them to complete it in 3 $2\frac{1}{2}$ days from the time of beginning the work?

Ans.—One man can do it in $4\frac{1}{3} \times 6 = 26$ days; all do $6 \times 2 = 12$ days' work in the start; $\therefore 26 - 12$, or 14 days' work remains to be done in $3\frac{1}{2} - 2 = 1\frac{1}{2}$ days, which will require $14 \div 1\frac{1}{2} = 10$ men to perform; $10 - 6 = 4$ must join them.

3. In twelve years I shall be seven-fifths of my present age. How long since I was five-sevenths of my present age?

Ans.—It is evident that 12 years is $\frac{2}{5}$ of my present age, and that I am now $12 \div \frac{2}{5} = 30$ years old. I was $\frac{5}{7}$ of 30, or $21\frac{3}{7}$ years old at the required time, and that was $30 - 21\frac{3}{7} = 8\frac{4}{7}$ years ago.

4. What must I pay for government 5 per cent, that my investment may yield 8 per cent?

Ans.—I get 5% of the face value of the bonds, which is 8% of my investment; hence I should pay $5 \times 100 \div 8 = 62\frac{1}{2}\%$.

5. Each side of a square is 8 feet. At each angle of the square a circle 8 feet in diameter is drawn, having its center at the angle of the square. What area of the square is not included in the circles.

Ans.—Area of square is $8^2 = 64$ square feet. The part each circle takes from the square is a quadrant, and as 4 quadrants make a circle, the area taken by the circles is equal to the area of one circle; $\therefore 64 - (4^2 \times 3.1416) = 13.7344$ sq. ft. is the required area.

6. Bought a horse for \$60; what must be my asking price that I may deduct 40 per cent of it and still make 30 per cent profit?

Ans.—I must sell the horse for 130% of \$60, or \$78; my asking price must be $\$78 \div .60 = \130 .

7. What is the length of the greatest cube that can be cut from a globe 18 inches in diameter?

Ans.—The diameter of globe is the diagonal of cube, or 18 inches; hence we have $\sqrt{(18^2 \div 3)} = 6\sqrt{3} = 6 \times 1.732050807569 = 10.392304845414$ inches.

8. Express decimally 4-7 of $3\frac{1}{2}$ -8, and 7-9 of $6\frac{3}{4}$ -11 $\frac{2}{3}$, and divide the former by the latter.

Ans.—The first operation gives $\frac{4}{7} \times \frac{7}{16} = \frac{1}{4}$, or .25; the second, $\frac{7}{9} \times \frac{8}{11\frac{2}{3}} = \frac{2}{9}$, or .45; then $.25 \div .45 = .5\frac{5}{9}$.

9. A can build a wall in $18\frac{3}{4}$ days, B in $31\frac{1}{4}$ days; how long will it take both together?

Ans.—A builds $\frac{4}{5}$ of the wall in a day and B, $\frac{4}{11\frac{1}{4}}$ of it; it will take both together $1 \div (\frac{4}{5} + \frac{4}{11\frac{1}{4}}) = 11\frac{2}{3}\frac{1}{2}$ days.

10. Sold an article at a gain of 40 per cent. If it had cost me \$800 more and I had sold it for the same sum, I would have lost 50 per cent: what did it cost me?

Ans.—Let 100% = the cost; then the selling price is 140%, and the supposed cost, 100% + \$800. To lose 50% or $\frac{1}{2}$, I must sell for $\frac{1}{2}$ of (100% + \$800) which is 50% + \$400. Then \$400 must be 140% - 50% = 90%, and the required cost is $400 \div .90 = \$444.44\frac{4}{9}$.

HISTORY.

1. Who first visited Florida? discovered the Mississippi? founded Quebec? conquered Mexico? Peru?

ANS.—Ponce de Leon. De Soto. Champlain. Cortes. Pizarro.

2. What two American colonies first established religious freedom? Who were their proprietors or founders? Their religion?

ANS.—Providence colony (1647) was the first; then came Maryland (1649). Roger Williams and the Maryland assembly in the "Act of Toleration." The Christian religion.

3. Who first sailed up the St. Lawrence? What distinguished Generals fell at Quebec?

ANS.—Cartier. Wolfe and Montcalm.

4. What Presidents held office two terms? Who died in office? Who were chosen by the House of Representatives?

ANS.—Washington, Jefferson, Madison, Monroe, Jackson and Grant. Harrison died April 4, 1841; Taylor, July 9, 1850; Lincoln, April 14, 1865; Garfield, Sept. 19, 1881. Thos. Jefferson and John Quincy Adams.

5. From whom and when were the following territories acquired: Florida, Louisiana, California, Alaska?

ANS.—Florida from Spain, Feb. 22, 1819, for \$5,000,000. Louisiana secretly from Napoleon I., April 30, 1803, for \$15,000,000. California from Mexico, by treaty May 19, 1848, partly by conquest and partly by purchase. Alaska from Russia, May 20, 1867, for \$7,200,000.

6. What were the Mecklenburg Resolutions, Wilmot Proviso, Dorr Rebellion, Shay's Rebellion, Webster-Ashburton Treaty?

ANS.—(1) A famous declaration of independence by the inhabitants of Mecklenburg Co., N. C., May 31, 1775. (2) It was introduced into Congress in August, 1846, by Mr. Wilmot, a democratic member from Pa., providing that there should be no slavery in territory thereafter annexed to the U. S. It was based on the celebrated ordinance of 1787, but failed to pass the senate. (3) An opposition in 1842 to the charter government of R. I., led by Thos. W. Dorr. (4) An armed force led by Daniel Shay, against high salaries fees and taxes that drained the province of Mass. of money. In December, 1786, this opposition suspended the session of the supreme court at Worcester. [5] Signed at Washington Aug. 9, 1842, and established the N. E. boundary of the U. S. between Me. and N. B.

7. How and for how long are United States Senators elected? Who are Senators from Ohio?

ANS.—By the State legislature for 6 years. Payne and Sherman.

8. Name, respectively, some of the principal causes which produced the Revolutionary war, war of 1812, Mexican war, and late civil war.

ANS.—Excessive taxation without representation. Impressment of American citizens by the British. Disputed boundary and the annexation of Texas. Slavery.

9. Name the plans of operation of Mexican war.

ANS.—To assail the Mexicans from the western coast and the coast of the Gulf, and make the invasion for the city of Mexico.

10. Which historic period is the most important? Why?

ANS.—The revolutionary period, because to it we owe our freedom and growth.

GEOGRAPHY.

1. Name the principal sea ports on the North Atlantic.

Ans.—Charleston, New York, Boston, Liverpool, London, Brest, Queenstown and Hamburg.

2. Define isothermal lines.

Ans.—Lines drawn on maps through places having a uniform average temperature.

3. Describe the motions of the earth.

Ans.—It turns on its axis from west to east, causing day and night. It moves rapidly around the sun in its orbit, which is an ellipse having the sun at one of its foci, and it performs this journey of 580,000,000 miles in about $365\frac{1}{4}$ days. This motion in conjunction with the inclination of the axis, causes the change of seasons. The earth has still another motion, which is thought to modify its climate in long periods of time. The poles of the earth are constantly moving around in a circle, as the upper pole of a sleeping top. This movement is completed in 27,000 years.

4. Describe the movements of the sea.

Ans.—*Waves* consist of the alternate rising and falling of successive ridges of water, and are caused usually by the wind. *Tides* are immense waves, which in mid ocean, are about three feet high and a few thousand miles in breadth. The cause is ascribed to the attraction of the sun and moon. *Currents* are rivers in the ocean itself, and are found in nearly all parts. The prime cause is probably the heat of the sun, but many of our scientists have concluded that the rotation of the earth, the unequal level of the ocean, and the winds may be factors in the circulation of the waters.

5. Name the principal seas and bays of the Atlantic north latitude.

Ans.—See text-book.

6. Name the provinces of Canada.

Ans.—British Columbia, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edwards Island.

7. Name the political divisions of S. America and their government.

Ans.—All republics, except Brazil, an empire, and Guiana, colony.

8. What and where is Itasca, Sicily, Montenegro, Murray, Banca?

Ans.—[1] Lake in Minn.; [2] island south of Italy; [3] a country of Europe; [4] river in Australia; [5] an island between Sumatra and Borneo.

9. Name the three chains of islands that form the West Indies.

Ans.—Bahama, Greater and Lesser Antilles.

10. Name in order the different ages of the earth.

Ans.—Azoic, or first forms of life; Palæozoic, or silurian, devonian and carboniferous age; Mesozoic or age of reptiles; Cenozoic, or age of mammals; Psychozoic, or age of man.

NOTE.—Our *Hints to Young Teachers* is crowded out, in consequence of giving full answers to the Examiners' Questions. The matter will appear in October issue. We invite the attention of our county teachers to the fact that hereafter all the questions in the lists shall be answered. In giving these answers, the editor will endeavor to introduce items of interest, which could not be expected in a manuscript. The solutions to questions in arithmetic may be considered models for students in the schools to imitate. The literature of arithmetic should be studied as well as that of all other branches, so as to express the facts in clear and attractive language.

ENGLISH GRAMMAR.

Answers to Queries.

1. Parse and diagram—He is *more than twice as old as his* father. J. F. ENGLE.

{	he	{	as	{	father	his
	is-old		is-old		as	
	twice		more than=over			

2. Diagram and give construction of words in italics.

ED. RYNEARSON.

How many thousands of my poorest subjects
 Are at this hour *asleep*! O sleep! O gentle sleep!
 Nature's soft nurse, how have I frightened thee
 That thou no more will weigh my eyelids down,
 And steep my memory in forgetfulness?
 Why rather, sleep, *liest* thou in smoky cribs
 Upon uneasy pallets *stretching* thee,
 And *hushed* with buzzing night-flies to thy slumber
 Than in the perfumed chambers of the great,
 Under the canopies of costly state
 And lulled with sounds of sweetest melody.—*Shakespeare*.

{	thousands	{	many	how	{	my
			of subjects	poorest		
	are-asleep	at hour	this			

(O sleep)	(	O sleep	{	gentle	{	nature's
			nurse	soft		

{	I	{	how	{	no more
			thee		down
			that		eyelids
			thou		memory
			will weigh		in forgetfulness
{	have frightened	{	and	{	my
			steep		my

(Sleep)

{	thou	{	stretching	{	thee
			and		upon pallets
			uneasy		
			hushed		with night-flies
			to slumber		thy
{	why	{	than	{	thou
			lulled		with sounds
{	rather	{	wouldst lie	{	in chambers
			perfumed		
			of great		
			the		of state
			costly		

3. Correct, if necessary, and explain the following:

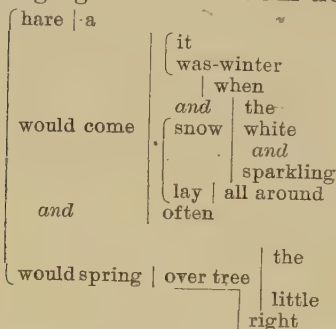
BuB.

1. Let's me and you take a walk in the garden. 2. Often touching will soil silver. 3. The event occurred ten years since.

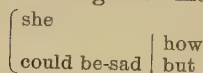
Ans.—1 Let us, you and me, take a walk in the garden. 2 Touching silver often will soil it. 3 The event occurred ten years ago.

4. Diagram—When it was winter, and the snow lay all around, white and sparkling, a hare would often come jumping along and spring right over the little fir-tree.

Id.



5. Diagram—How could she but be sad.



NOTE.—Mr. J. D. Hignight, of Brunswick, Mo., school commissioner of Char-
 itan County, diagrammed Shakespear in query No. 2, by Sanders's method,
 nearly as we give it by Eubank's.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

660. What were the Caroline Books?

Ans.—The Caroline Books are four works drawn up at the request of Char-
 lamagne against the decrees of the second council of Nice on the adoration of
 images, and contained in the *Capitulaire Prolixium* of Chalemagne.

J. H. W. SCHMIDT.

669. Give the name and year of all the established Wedding an-
 niversaries.

LIBRA.

Ans.—At the end of the 1st year, the Cotton wedding; end of 2d year, Paper;
 end of 3d year, Leather; end of 5th year, Wooden; end of 7th year, Woolen;
 end of 10th year, Tin; end of 12th year, Silk and Fine Linen; end of 15th year,
 Crystal; end of 20th year, China; end of 25th year, Silver; end of 30th year,
 Pearl; end of 40th year, Ruby; end of 50th year, Golden; and end of 75th year,
 Diamond.

ED. RYNEARSON.

670. State the notable events that occurred July 4.

Id.

July 4, 1629, Charlestown, Mass., was founded by a company of Puritans
 from Salem.

July 4, 1631, the *Blessing of the Bay*, a vessel of 30 tons, made in New England by Gov. Winthrop, was launched at Medford, Mass., and is usually called the first vessel built in New England.

July 4, 1636, Providence. R. I., was founded by Roger Williams.

" 4, 1754, Washington was attacked in Ft. Mifflin by a large force of French and Indians, and forced to surrender after nine hours severe fighting.

July 4, 1776, American Independence was declared. On the afternoon of same day Congress adopted a resolution that Benj. Franklin, Thos. Jefferson and John Adams be a committee to prepare a device for seal for the U. S.

July 4, 1777, the first anniversary of the Declaration of Independence was celebrated at Philadelphia with great joy.

July 4, 1778, a duel was fought between Gens. Cadwallader and Conway, because of Conway's opposition to Washington. He was wounded. Also, Fort Wayne in Wyoming Valley was taken, and the whole region burned and desolated in the most scathing manner.

July 4, 1781, a fight took place at Jamestown Ford, between Cornwallis and Wayne who was entrapped by stratagem, but by the assistance of La Fayette escaped.

July 4, 1788, a great celebration was held at Philadelphia in honor of the newly adopted constitution.

July 4, 1789, the first Revenue Bill became a law.

" " 1817, Work was begun at Rome, N. Y. on Erie Canal.

" " 1826, Thomas Jefferson and John Adams, both ex-presidents of the U. S., died.

July 4, 1828, the corner-stone of the Baltimore & Ohio R. R. was set by Chas. Carrollton, the last surviving signer of the Declaration of Independence, at more than 90 years of age.

July 4, 1831, James Monroe, the fifth Pres. of the U. S., died.

" " 1834, the Anti-Abolition Mob in N. Y. caused great excitement.

" " 1845, the Legislature of Texas ratified the "Annexation Bill" passed by the U. S. Congress.

July 4, 1848, Robt. Winthrop laid the corner stone of Washington Monument, which was completed at the beginning of this year and dedicated Feb. 21, 1885. It is the highest structure in the world, being 555 feet high.

July 4, 1857, *Dead Rabbit Riot* occurred in N. Y., and 11 persons killed.

July 4, 1863, Vicksburg surrendered to Grant.

" " 1866, a great fire swept nearly one third of Portland, Me., out of existence. The fire was started by a boy carelessly throwing a fire cracker among some shavings.

July 4, 1868, the Democratic National Convention assembled at N. Y., and nominated Horatio Seymour of N. Y. for Pres., and Francis P. Blair, of Mo., for Vice President.

July 4, 1873, a destructive tornado occurred in Ohio, Ind., Wis., and Mo.

" " 1876, the one hundredth anniversary of the Declaration of Independence was celebrated patriotically throughout the Union. At the Centennial Exhibition it was celebrated in Independence Hall.

July 4, 1882, the excursion steamer, *Sciota*, was sunk by collision with another vessel on the Ohio river. Fifty-eight lives lost.—*Encyclopedia of the History and Biography of America*.

HATTIE HARPER.

671. Give a brief history of Easter, and the date of its occurrence for each year in the 19th century, with method of calculating the same. *Id.*

Ans.—Let y = the year, and $y \div 19$ give a remainder = a , $y \div 4$ give a remainder = b , $y \div 7$ give a remainder = c , $(19a + 4) \div 30$ give a remainder = d , $(2b + 4c + 6d + B) \div 7$ give a remainder = e ; then Easter = $22 + d + e$ of March, or Easter = $d + e - 9$ of April. Should the formulas give the 26th of April, seven days must be subtracted. From 1800 to 1899, $A = 23$, $B = 4$. These formulas are due to the celebrated Gauss.

WM. HOOVER.

Applying the formulæ given by Prof. Hoover, we get the following dates for Easter to the end of this century: April 25, 1886; April 10, 1887; April 1, 1888; April 21, 1889; April 6, 1890; March 29, 1891; April 17, 1892; April 2, 1893; March 25, 1894; April 14, 1895; April 5, 1896; April 18, 1897; April 10, 1898; and April 2, 1899.

EDITOR.

672. Why do the edges of boards turn up when one side of board is exposed to the sun's rays?

WARREN LOY.

Ans.—Because moisture is evaporated faster from one side than from the other, and the wood contracting assumes a bent form. To straighten a warped board apply a little moisture to the concave side and heat to the other. The first effect will be an increase in the warp. Why?

A. M. SCRIPTURE.

673. What can be said of the antiquity of Astronomy? When were the sun spots discovered?

Id.

Ans.—Astronomy is probably the most ancient of all the sciences. Laplace speaks of Chinese observations 1,100 B. C. Some Chaldean observations date as far back as 2,250 years before Christ, and Mr. Baily fixes the time of a conjunction of Mars, Jupiter, Saturn, and Mercury, mentioned in Chinese records, at 2,449 years before Christ. In the Scriptures, some parts of which are very ancient, we have several allusions to the science of astronomy. In the first chapter of Genesis we have an account of the creation of Sun, Moon and Stars. In the book of Job, written 1,500 years before Christ, we read of several constellations that bear the same names now that they did three thousand years ago. Read Job 9-9, and 38-31, 32. The first astronomers were shepherds, who were led to this study by observing the movements of planets, while watching their flocks from year to year in the open fields. Thales, one of the seven wise men of Greece, was the first regular teacher of Astronomy, B. C. 600. The sun spots were discovered by Galileo, who invented the teloscope (1609), with this telescope but one inch in diameter and magnified objects but 30 times, he discovered the spots on the sun, the phases of Venus, the satellites of Jupiter, etc., etc. From 1611 to 1629 we learn that the sun was never found clear of spots, except a few days in December, 1624, therefore, the spots must have been discovered between 1609 and 1611.

J. W. DEEBERY.

674. Name political divisions of Africa at the present time.

J. FINNEY ENGLE.

Ans.—See map in any lately revised geography or cyclopedia.

675. Give the provisions of the treaty of Ghent, 1814.

Id.

Ans.—It stipulated that each nation should try to arrest Indian hostilities and the slave trade.

ED. RYNEARSON.

The treaty provided that all places captured by either party during the war should be restored to their rightful owners. Arrangements were made for determining the northwest boundary of the U. S., and for settling matters of minor importance. The treaty was silent on the subject of impressments, the cause of the war.

GEO. L. SHANER.

676. Locate and describe the U. S. Magnetic Observatory, and tell for what it was established.

C. A. S.

Ans.—It is located at Los Angeles, Cal. The building is partly underground with double walls a foot thick and a space of several feet between them. Copper and not iron has been used in the metal work. In the magnet room are three magnets. The first, suspended by a strand of unspun silk, records variations in declination only. The second, by two strands so that the magnet must point east and west, and determines the strength of the magnetic force. The third, balanced on a knife edge, shows any change of dip or vertical force. A mirror is attached to each magnet, which reflects a dot of light from a lamp

upon a cylinder covered with photographic paper. This cylinder turns once in 24 hours, and the dot of light makes a visible line on the paper, thus recording the slightest turns or movements of the magnet. The variations of the magnetic needle varies in different parts of the U. S. In New Mexico and Arizona there has been no change for several years. The yearly increase has been $7\frac{1}{2}'$ in the northern part of the continent.

EDITOR.

678. Was there any circumstance in connection with the life of Tennyson, that caused him to write "Locksley Hall"? What can be said to be the key note of this poem?

Id.

ANS.—The hero of the poem, the Lord of Locksley Hall, was jilted by his cousin Amy for a rich boor, and we think the climax or key note in this poem is the flood of vehement scorn and indignation poured forth by the unhappy victim. It is understood that the poem was occasioned by a similar incident in the life of Tennyson. See Brewer's late work, *The Reader's Hand-Book*.

EDITOR.

Answered by William Hoover.

679. Upon the strength of what productions especially can Bryant, Whittier, Longfellow, Lowell, Bayard Taylor, and Holmes lay claim to an immortality?

Id.

ANS.—Bryant's *Thanatopsis*, Longfellow's *Evangeline*, Whittier's *Home Ballads*, Lowell's *Biglow Papers*, Holmes's *Autocrat of the Breakfast Table*, Bayard Taylor's *Summer and Winter Pictures of Sweden, Denmark and Lapland*.

WILL H. HAMILTON.

ANS.—There is very little, if anything, in the productions of the authors named upon which an immortality can be based: *Thanatopsis* and *A Psalm of Life* are most nearly entitled to the distinction, perhaps.

WM. HOOVER.

680. By whom and under what circumstances was the following said: "Choose, each man, what best becomes a brave Castilian. For my part I go to the south"?

ED. RYNEARSON.

ANS.—Francisco Pizarro, was born at Truxillo, Spain, about the year 1471, and was the son of a soldier who had gained a reputation for valor. He accompanied Balboa, across the mountains to the Pacific. The reports of the kingdom of Peru excited his venturesome spirit, and on the 14th of Nov., 1524, he left Panama with one vessel and about one hundred men. Failing under many distressing difficulties to reach Peru, he returned to Panama again. In 1526, he again sailed southward, and his vessel was the first to cross the equinoctial line on the western coast of S. A. In 1527, after severe trials and hardships when almost all wished to give up and go back to Panama, Pizarro drew a line on the sand, and pointing with his sword said, "There lies Peru with its riches and the glory of conquest; here lies Panama with its poverty. Choose, each man, what best becomes a brave Castilian. For my part, I go to the south." Stepping across the line he was followed by a small number, who thus became the nucleus of the force which finally subdued the great kingdom. The timid ones sailed for home. In June, 1541, he was assassinated in his own home in Lima, and his remains now repose in the cathedral at that place.

JOHN GOTTSCHALL.

681. Where is the highest city on the globe, and when founded?

Id.

ANS.—Potosi, in Bolivia, founded in 1545, and situated on the northern declivity of the Cerro de Potosi. Elevation 13,300 feet. Population at present about 20,000, but it is believed that in the 17th century it had about 150,000.

JAMES A. COTTRELL.

682. Give the origin and meaning of the phrase, "The skeleton in every closet."

E. B. HIESTAND.

Ans.—"Something to annoy and keep out of sight. A woman had an only son who obtained an appointment in India, but his health failed, and his mother longed for his return. One day he wrote a letter to his mother with this strange request: 'Pray, mother, get some one who has no cares and troubles to make me six shirts.' The widow hunted in vain for such a person, and at length called upon a lady who told her to go with her to her bedroom. Being there she opened a closet which contained a human skeleton. 'Madam,' said the lady, 'I try to keep my sorrows to myself, but every night my husband compels me to kiss that skeleton.' She then explained that the skeleton was once her husband's rival, killed in a duel. 'Think you I am happy?' The mother wrote to her son, and the son wrote home: 'I knew when I gave you the commission that every one had his cares, and you, mother, must have yours. Know then that I'm condemned to death, and can never return to England. Mother, mother! there is a skeleton in every household.'"—*Brewer's Dictionary of Phrase and Fable*.

EDITOR.

683. Who invented the electric light?

Id.

Ans.—See Thos. Brawley's answer to query 501 in *School Visitor*, Vol. VI., p. 27.

JOHN KNIESLY.

Sir Humphrey Davy, in 1813, first obtained this light, while experimenting with the great battery of the Royal Institution in London. The important discovery of the divisibility of the electric current for the production of the Voltaic arc between carbon points was made by Jablochhoff; and the experiments of Edison, Maxim, Brush and others have led to practical results.—*People's Cyclopaedia*.

EDITOR.

684. Who presented Cornwallis's sword to Gen. Lincoln at Yorktown?

JNO. KNIESLY.

Ans.—"Cornwallis, unable to bear up against the humiliation of marching at the head of his garrison, constituted Gen. O'Hara his representative on the occasion." It was he that delivered Cornwallis' sword to Lincoln.

WM. S. DAVIDSON.

685. Why is the presiding officer of the House of Representatives called the Speaker?

Id.

Ans.—As the representative of the House, he communicates its resolutions and conveys its thanks or its censures, to others. He is thus the mouth-piece of the House, whence his title seems to be derived.

WILL H. HAMILTON.

686. Give author of the book, *The Wonders of the Invisible World*.

JOHN FITZGERALD.

Ans.—*The Wonders of the Invisible World* was written by Rev. Cotton Mather, a young minister of New England, and one of the most ruthless opponents of witchcraft, whose remarkable learning gave a fatal importance to his opinions. The book was approved both by the governor of Massachusetts, and by his father, the president of Harvard.

JOHN KNIESLY.

687. Give an account of the persons known as, "The Happy Old Couple."

Id.

Ans.—Darby and Joan, the hero and heroine of the ballad, called *The Happy Old Couple*, were said to have lived more than a century ago, in the town of Healaugh, in the West Riding of Yorkshire. Timperley says that Darby was a printer in Bartholomew Close, who died in 1730. Henry Woodfall, one of his apprentices, wrote the ballad.—See *Webster's Dictionary*.

G. H. THOMAS.

688. Who was "Judas of the West"? Give incident.

Id.

690. Describe the monument in the U. S. that stands on the 77th meridian.

Id.

Ans.—There is no monument on the 77th meridian. The Washington is about 77° 2'.

EDITOR.

691. Give reason for Rhode Island's two capitals? CLARA BURK.

Ans.—Because the state was formed in colonial times by the union of Rhode Island, capital Newport, and Providence Plantations, capital Providence, under a patent secured by Roger Williams in 1643, which remained in force till the charter was obtained from Charles II. in 1663. In those times the legislature met alternately at Newport and Providence, and the two capitals were retained under the new constitution of 1842.

EDITOR.

692. Give the origin of the word *skedaddle*?

M. T. PATE.

Ans.—“Stormouth refers it to the Icelandic *Skyndilegast*, which he thinks is connected with the Dutch *schudden*, to shake, to jolt, and old English *scuddle*, to run away all of a sudden.”—*Henkle*. “It is said to be of Swedish and Danish origin, and to have been in common use for several years throughout the north-west, in the vicinity of immigrants from those nations.”—*Webster's Unabridged Dictionary*.

EDITOR.

I offer the following from *Gleanings for the Curious*: This word may be easily traced to a Greek origin. The verb *skedannumai*, of which the root is *skeda*, is used freely by Thucydides, Herodotus, and other Greek writers in describing the dispersion of a routed army. From the root *skeda* the word *skedaddle* is formed by simply adding the euphonious termination *dle* and doubling the *d* as required by the analogy of our language in such words. In many words of undoubted Greek extraction much greater changes are made. The Swedes have a similar word, *skuddadahl*, and the Danes another *skygdedeht*, both of which have the same signification. An old version of the Irish New Testament contains the passage, “For it is written, I will smite the Shepherd, and the sheep of the flock shall be *sgedad ol*.” This compound Irish word *sgedad ol* (all scattered or utterly routed) was probably used by some Irishman at Bull Run, and being regarded as felicitous, was at once adopted.

J. H. W. SCHMIDT.

693. Who is the author of: “The worst men often give the best advice. Our deeds are sometimes better than our thoughts.” *Id.*

Ans.—This quotation is from Bailey's *Festus*, Scene, Village Feast.

J. H. W. SCHMIDT.

694. Is Capt. John Smith's, *True Relation of Virginia*, still in existence? If so, where can it be obtained?

JNO. GOTTSCHALL.

Ans.—It is out of print.

695. In the *Library of Universal Knowledge* (from Chambers Enc.) it is stated, in treating of Probabilities, that the product of 1, 3, 5, 7, 9 . . . 28999, can be easily, approximately obtained by the higher analysis. What branch of higher analysis and what author?

W. L. H.

Ans.—The finite product is found by the methods of Definite Integrals, for which see the more extensive treatises on the Dif. and Int. Calculus; also by those of the Calculus of Finite Differences, for which see Hall's, art. 111, Boole's, pp. 93-94, 2d ed., Hymer's, art. 71, p. 44, ed. 1839. For applications, see DeMorgan's *Theory of Probabilities*.

WM. HOOVER.

696. Give a brief explanation of Dr. Franklin's experiment, by which he drew the lightning from the clouds and confined it, to prove its identity with frictional electricity.

J. W. DEBERRY.

ANS.—In the summer of 1752, Franklin made a grand discovery respecting electricity. His original plan was, to erect on some elevated place a sentry box, insulated by being fixed in a cake of resin, and mounted with a pointed iron rod. He conceived that electrified clouds passing over this would impart to it a portion of electricity, which would be made evident by the emission of sparks when a conductor was presented. While he was awaiting the erection of a spire (Philadelphia then afforded no opportunity for experiments), it occurred to him that a kite might be used to reach the clouds. So he attached to two cross sticks a silken handkerchief with an iron point at the top and a key attached to the lower end of the hempen string. After several disappointments he succeeded in receiving from the string or key a strong spark with the knuckles of his hand. A vial was charged, a shock given, and all the experiments made which are usually performed with electricity. WARREN LOX.

697. When and how was slavery abolished in the District of Columbia?

NEMO.

ANS.—Much learned and angry discussion took place in congress on the question of slavery in the District of Columbia. The fifth clause of Clay's *Omnibus Bill* provided for the abolition of slavery, but it never became a law. Prior to the rebellion it was claimed, that Virginia and Maryland, both slave states, had ceded the district to the United States without affixing any conditions as to the future status of the slave, and that it would be a shameful violation of an implied contract to emancipate the slaves. On the other hand all in the north felt that slavery in the capital was a disgrace to the nation and a libel on our Declaration of Independence. It was not until about the middle of April, 1862, that the act of emancipation was passed, and being signed by President Lincoln, it became a law whereby the slaves in the district were set free at once.

EDITOR.

698. "Decoration Day" always comes on May 30. Can you tell why and when this date was established?

Id.

ANS.—It is said that this day was chosen because the discharge papers of the last volunteers mustered out of U. S. Army in the Civil War, were dated May 30 (1866). Previous to 1866 our country observed no National Flower Day.

EDITOR.

699. What is the difference in the height of the Pacific Ocean and the Caribbean Sea, as found in the survey of the Panama Canal?

ANS.—There are times when the waters of the Pacific are nearly three feet higher than those on the opposite side of the isthmus, owing to the difference in the rise of the tide; but the mean level on both sides is believed to be exactly the same.

ED. RYNEARSON.

CREDITS.

- J. W. DEBERRY, *Littleton, W. Va.*, 672.
 JOHN GOTTSCHALL, *Gettysburg, Ohio*, 675.
 THOS. MILLER, *Sharpville, Ind.*, 669, 680.
 GEO. L. SHANER, *Stewarts Station, Pa.*, 669, 670.
 WILLIAM HOOVER, *Athens, Ohio*, 680, 682.
 HATTIE HARPER, *Horatio, Ohio*, 675, 683.
 WILL H. HAMILTON, *Monticello, Mo.*, 683, 684.
 JOHN KNIESLY, *Horatio, Ohio*, 675, 697.
 WM. S. DAVIDSON, *Lewisburg, O.*, 680, 683, 686, 697.
 CHARLES MANN, *Gettysburg, O.*, 670, 681, 683, 692.
 WARREN LOX, *Pyrmont, O.*, 669, 670, 683, 684.
 G. H. THOMAS, *German, O.*, 669, 673, 683, 684, 692.
 ED. RYNEARSON, *Gettysburg, O.*, 673, 677, 680, 681, 683, 684, 697.

QUERIES.

721. When was the site of Cincinnati settled and how did this city get its name? A. P. S.
722. Give sketch of the author of "Curfew must not ring to-night".
723. Was the purchase of Louisiana constitutional? Explain.
724. Who was Longfellow's "Beautiful Helen of Maine"? Id.
725. Give a short sketch of Queen Elizabeth's affection toward the earl of Essex after his conviction of treason. G. L. S.
726. Why will a brunette endure the sun's rays better than a blonde? Wm. S. DAVIDSON.
727. Who discovered mesmerism? Galvanism? Id.
728. Who said "Am I on a bed of roses"? Give incident. Id.
729. When and by whom was the Christian-Era Dating introduced? H. A. WOOD.
730. How does the length of a common or Statute mile compare with the length of the mile in different countries? Id.
731. Why is it tiresome to walk in miry clay? NEMO.
732. How, when and by whom were the equatorial and polar diameters and the circumference of the earth established? Id.
733. Explain how the flowers of our common clover are fertilized by the bumblebee. L. B.
734. Give the cause of the variation in the color of ocean waters. Of the sky. Id.
735. Explain the meaning of "The Truce of God." Id.
736. How do different kinds of corn mix when planted near each other? Id.
737. Tell who captured Jeff. Davis, and where both parties now live. T.
738. Explain simple process by which water may be made to boil by being cooled, and to stop boiling by being heated. Also, how two liquids at the same temperature, may be placed that the one will boil and the other freeze. J. W. HOUSTON.
739. Give the puzzle of the "Christians and the Turks." EZRA SMITH.
740. To whom is the invention of guns attributed? M. T. PATE.
741. Who was the "Log-Cabin Candidate" for president? The "Wonderful Doctor"? What is meant by "Plymouth Rock"? S. A. SMITH.
742. Give a lucid account of the following events: (a) The humbling of Henry IV. by Pope Gregory VII. at Canossa (1077). (b) Removal of the papal see to Avignon (1309). (c) Great schism of the West; Urban VI. at Rome; Clement VII. at Avignon (1379). (d) Council of Pisa and the three popes (1409). J. W. DEBERRY.
743. Is the equator a circle? If not, explain. COSMOS.
744. Who was the author of the Ordinance of 1787? Id.

Answers should be received on or before Oct. 10.

BOOK NOTICES.

GEMS FOR LITTLE SINGERS. A collection of Easy and Pleasing Songs, for Primary and Kindergarten Schools, and the Nursery. By Elizabeth U. Emerson and Gertrude Swayne. Assisted by L. O. Emerson. Boston: Oliver Ditson & Co. Price 30 cents.

This is a splendid little book, containing sweet songs and gay pictures, which can not fail to cheer and comfort the little folks. The authors are eminent vocalists of Boston and first-class musicians, who appreciate and sympathize with the taste of the young singers.

FRESH FLOWERS, A Song Book for the Infant Classes of Sunday Schools, by Emma Pitt. Same publishers. Price 25 cents.

In *Fresh Flowers* we have fifty-five good songs for the children, adapted in every respect to the voices and culture of little singers. It can be used in the day school with good effect.

HAPPY MOMENTS. For Public Schools, Seminaries, Normal Schools, and Juvenile Classes. Containing the Author's Improved Plan of Sight Reading, and a Rare Collection of Secular and Sacred Songs for the School Room, Concerts, etc. By S. W. Straub. Published by the Author, 236 State St., Chicago, Ill. Price 50 cents, or \$5.00 per dozen. Sample Copy, 30 cents.

Forty pages are devoted to *Theory and Practice*, enabling any teacher to give instruction, and a hundred and thirty-four, to songs new and old that will add materially to the "happy moments" of the schoolroom. Great care was taken in this work, both in the selection of words and in the tunes. We commend it heartily.

SCHOOL HERALD. Published semi-monthly, by W. I. Chase, 125 South Clark St., Chicago, Ill. Price, 75 cents per year.

As a systematic exponent of the history of our own times, this magazine ranks among the best. It was started four years ago, and has given a faithful history of the world during the Garfield-Arthur Administration. Its history of Cleveland's first term will be carefully compiled and fully illustrated. If you would keep posted on important events without going through bushels of chaff to get a few grains of wheat—the daily newspaper—we recommend to you the *School Herald*. Write to the publisher for free sample copies.

ANNALS OF MATHEMATICS. Edited by Ormand Stone and William M. Thornton, Professors in the University of Virginia. Bi-monthly, 24 pp. Price \$2.00 for six numbers, or 50 cents a number. Address, University of Virginia, Va.

This magazine is the successor to the *Analyst*, and is well printed and ably edited. We cheerfully recommend it to all interested in the beauties of the higher mathematics, pure and applied. We give it a hearty welcome as an exchange, and wish it a prosperous and useful career.

DEMOREST'S ILLUSTRATED MONTHLY MAGAZINE. Published by W. Jennings Demorest, New York. Price, \$2.00 a year, in advance.

The September number of this popular magazine is decidedly one of the best we have had. The story "Bryanstone and Wife," by Philip Bourke Marston, is a capital one, and "Orders of Knighthood," an illustrated article. "A Happy Island," "The Story of Ludwig Sophr," "A Maid of Honor of the Last Century," and "An Old Italian City," are well worth reading. The various departments are carefully filled, and contain much that is useful in the household. The frontispiece is a fine oil picture called "Goodbye."

We furnish it to our subscribers at \$1.50 a year. The volume begins with November. Send \$2.50 for *Visitor* and the magazine next year.



EDITED BY

JOHN S. ROYER.

VOL. VI.

OCTOBER, 1885.

No. 10.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

770. *By Request.*—A gives B \$210 May 11, and takes his note at 5 months, agreeing not to exact interest. A sells the note to C June 11, for \$205, and B makes good to A the \$5 so lost. When the note falls due, C exacts interest at 7% per annum. Find the rate per cent per annum gained, lost or paid by the several parties to this transaction.

By the Editor.

At the maturity of the note C receives the amount of \$210 for 5 mo. at 7%, or $\$210 \times 1.029\frac{1}{6} = \216.125 ; he pays \$205 4 months previous, and makes $\$216.125 - \$205 = \$11.125$ interest, which is equivalent to \$33.375 a year; hence his rate is $33.375 \times 100 \div 205 = 16\frac{5}{7}\%$ per annum. B pays $\$5 + \$6.125 = \$11.125$ interest for 5 months, on the use of \$210 for one month and \$205 for 4 months, which is the same as \$1030 for one month or $\$85.83\frac{1}{3}$ a year; hence he pays $11.125 \times 100 \div \$5.83\frac{1}{3} = 12\frac{9}{10}\%$ per annum. A loses one month's interest or $\frac{7}{12}\%$ per annum.

Solved by MESSRS. GUNDER and REED.

771. *By N. R. OLIVER, Dorchester, Ont.*—To what power must I raise 14 so as to produce 123456789?

By WM. WILEY, Detroit, Mich.

The logarithm of 123456789 is 8.0915149, and the logarithm of 14 is 1.1461280; then the required power is $8.0915149 \div 1.1461280 = 7.05987$.

Solved by MESSRS. DAVISON, WOOD and GUNDER.

NOTE.—With the beginning of next volume, we shall commence the publication of brief papers on important subjects and problems of mathematics from our contributors, which will add an interesting feature to this department.

772. *By the same.*—I found by looking through a window which was 32 ft. from where I stood, a distant building appeared to fill one of the window panes, the pane being 20 inches long. On my approaching to within 3 feet of the window the building appeared to take up 2 inches of the pane, the bottom of the building and pane still appearing coincident. What was the distance of the building from the first point of observation

By J. C. ROEBUCK, Rock Falls, Iowa.

Let x = the distance from building to house. Suppose the eye on a level with bottom of the window, then

$$3 : 2 :: 3 + x : \text{height of building,}$$

and

$$32 : 20 :: 32 + x : "$$

hence $\frac{1}{3}(640 + 20x) = \frac{1}{3}(6 + 2x)$, or $1920 + 60x = 192 + 64x$, whence $x = 432$, and the required distance is $432 + 32 = 464$ feet.

By D. H. DAVISON, Minonk, Ill.

Let x = required distance in feet; y = height of building in inches. Put $x = 32$ feet, $b = 20$ inches, $c = 3$ feet, and $d = 2$ inches; then

$$a : b :: x : y \dots (1), \quad c : d :: x - (a - c) : y \dots (2), \quad ay = bx \dots (3).$$

From (1), $cy = dx - d(a - c) \dots (4)$. From (2), $cay = bex \dots (5) = (3)c$,

and $cay = adx - ad(a - c) \dots (6) = (4)a$; $\therefore (ad - bc)x = ad(a - c)$.

From which $x = ad(a - c) \div (ad - bc) = 464$ ft., the required distance.

Also $y = bd(a - c) \div (ad - bc) = 290$ in. = 24 ft. 2 in. height of building.

Solved by L. A. REED, H. A. WOOD, WM. WILEY, A. L. FOOTE, LEWIS MCKIBBEN, HENRY GUNDER, and A. M. SCRIPTURE.

773. *By HENRY GUNDER, New Castle, Ind.*—Let $x^2 \div a^2 + y^2 \div b^2 + z^2 \div c^2 = 1$ be the equation of an ellipsoid. Find the volume of a segment of one base parallel to the plane of (y, z) , and deduce from the result the volume of similar segments of spheroid and sphere.

By the PROPOSER.

A section of the ellipsoid parallel to the plane of (y, z) is an ellipse whose equation is

$$\frac{y^2}{b^2} = \frac{z^2}{c^2} = 1 - \frac{x^2}{a^2},$$

where x is to be considered constant for the time being. The area of this ellipse, which is also the area of the base of segment, will be expressed by

$$\pi \int yz dx$$

and putting $y = 0$ in the first equation, we have $z = c \sqrt{1 - (x^2 \div a^2)}$; also putting $z = 0$, we have $y = b \sqrt{1 - (x^2 \div a^2)}$. Substituting these in the above integral, we have for the volume

$$V = \pi bc \int \left(1 - \frac{x^2}{a^2}\right) dx = \pi bc \left(x - \frac{x^3}{3a^2}\right).$$

The limits of x are a , and $a-h$, when h =height of segment. Substituting and reducing, $V=\pi bck^2(3a-h)\div 3a^2$. For the spheroid we must have $b=c$ for prolate, or $a=b$ for oblate. Choosing the former $V'=\pi b^2k^2(3a-h)\div 3a^2$. For the sphere $a=b=c$; hence we have $V''=\pi ah^2-\frac{1}{3}\pi h^3=\pi ah^2-2(\frac{1}{6}\pi h^3)$.

The last, when put into words, gives the following *Rule* for the volume of a spherical segment—given radius of sphere and height of segment.

RULE.—"The volume of a spherical segment of one base is equal to the volume of a cylinder the radius of whose base equals the height of segment and axis equals the radius of the sphere, *minus* twice a sphere whose diameter is the height of the segment."

Solved by PROF. WM. HOOVER, of the State University, Athens, Ohio.

774. By A. L. FOOTE, *Hempstead, N. Y.*—A man had an empty conic cistern, apex down and open at the top. He had also a large parabolic kettle the diameter of which was greater than that of the cistern. Seeing a rain coming, and being anxious to secure as much water as possible he placed the kettle in the cistern and removed a plug from its bottom to allow the water to pass into the cistern. Had the plug not been removed the part of the kettle within the cone would have been exactly filled by the rain during the storm, which fell d inches on a level. Now admitting the diameter of the kettle to be a inches and its altitude b inches, what was the depth of water collected in the cistern? [Make numerical application.]

By H. GUNDER, *New Castle, Ind.*

From $y^2=4px$, the equation to the parabola, we find by putting $\frac{1}{2}a$ for y and b for x , $4p=a^2\div 4b$. The amount of water caught is then $\frac{1}{4}a^2\pi d$, assuming the sides of cistern tangent to the kettle, the properties of the parabola give $2z$ =depth of cistern, when z is the abscissa of the cistern's edge. Then putting r =radius of top of cistern, we have $r^2=4pz$. The volume of the segment of kettle within the cistern is $\pi r^2\div 8p$, which must equal the water caught, $\frac{1}{4}a^2\pi d$. Hence $r^4=2a^2dp$, and $2z=2\sqrt{2ab}$ =depth of cistern. The tangent of the semi-vertical angle of cone is $r\div 2z=\frac{1}{4}a\sqrt{(1\div 2db^3)^{\frac{1}{2}}}$, and if v =the depth of the water in cistern, we have

$$\frac{1}{8}v[\frac{1}{4}va\sqrt{(1\div 2db^3)^{\frac{1}{2}}}]^2\pi=\frac{1}{4}a^2\pi d,$$

From which $v=(12bd\sqrt{2bd})^{\frac{2}{3}}$.

This result is independent of a , the diameter of the kettle. Any number may be put for b and d , only $d<b$.

775. By PROF. DEVOLSON WOOD, *Hoboken, N. J.*—A paraboloidal vessel is partly filled with a liquid, and rotates about its vertical axis with a uniform angular velocity; required the entire pressure against the surface.

By PROF. WILLIAM HOOVER, Ohio University, Athens, Ohio.

Let p = the pressure, ρ = the density, X, Y, Z the components of the external impressed forces per unit of mass, at the point (x, y, z) at the time t , u, v, w , the components parallel to the co-ordinate axes of the velocity at (x, y, z) at the time t , and the dynamical equations of motion are

$$\begin{aligned}\frac{du}{dt} + u \frac{du}{dx} + v \frac{du}{dy} + w \frac{du}{dz} &= X - \frac{1}{\rho} \frac{dp}{dx}, \\ \frac{dv}{dt} + u \frac{dv}{dx} + v \frac{dv}{dy} + w \frac{dv}{dz} &= Y - \frac{1}{\rho} \frac{dp}{dy}, \\ \frac{dw}{dt} + u \frac{dw}{dx} + v \frac{dw}{dy} + w \frac{dw}{dz} &= Z - \frac{1}{\rho} \frac{dp}{dz}.\end{aligned}$$

If ω be the constant angular velocity, we have for this problem, $u = -\omega y$, $v = \omega x$, $\omega = 0$, $X = 0$, $Y = 0$, $Z = -g$, and the above equations become

$$\frac{1}{\rho} \frac{dp}{dx} = \omega^2 x, \quad \frac{1}{\rho} \frac{dp}{dy} = \omega^2 y, \quad \frac{1}{\rho} \frac{dp}{dz} = -g,$$

the common integral of which is

$$\frac{p}{\rho} = \frac{1}{2} \omega^2 (x^2 + y^2) - gz + C,$$

the whole pressure on a unit of mass at the point (x, y, z) .

If $p = \rho C = C'$, $x^2 + y^2 = (2g \div \omega^2) z$, a paraboloid, the lowest point of which now take for the origin of co-ordinates, distant from the vertex of the containing vessel m , referred to which the equation to the containing surface is $x^2 + y^2 = 2p(z + m)$. Multiplying the expression for the pressure upon a unit of mass in the surface by

$$dS = \sqrt{\left\{ 1 + \left(\frac{dz}{dx} \right)^2 + \left(\frac{dz}{dy} \right)^2 \right\}} dx dy, \text{ and integrating,}$$

$$\frac{p}{\rho} S = \iint \left\{ \frac{1}{2} \omega^2 (x^2 + y^2) - gz \right\} \sqrt{\left\{ 1 + \left(\frac{dz}{dx} \right)^2 + \left(\frac{dz}{dy} \right)^2 \right\}} dx dy.$$

Substituting z , $dz \div dx$, $dz \div dy$, obtained from the equation of the surface of the given paraboloid, we find the entire pressure on the inner surface of the containing vessel in terms of x, y, z and constants.

776. By H. A. Wood, New York City.—What is the length in yards of a piece of cloth originally $1\frac{1}{3}$ yds. wide, if the cloth after shrinking 10% in length and width, contains 9 full square yards?

By W. L. HARVEY, Maxfield Me.

The width of cloth after shrinking is $\frac{9}{10}$ of $1\frac{1}{3} = \frac{3}{5}$, and $9 \div \frac{3}{5} = 7\frac{1}{2}$,

the length of cloth after shrinking; therefore $7\frac{1}{2} + \frac{1}{9}$ of $7\frac{1}{2} = 8\frac{1}{3}$, the original length.

By LEWIS MCKIBBEN, *Springfield, Ohio.*

The length required is simply $9 \times \frac{1}{9} \times \frac{1}{3} \times \frac{1}{9} = 8\frac{1}{3}$ yards.

Solved by MESSRS. LEISY, SCRIPTURE, WILEY, FOOTE, REED, GUNDER, PROPOSER.

777. *By the same.*—Bought an article and sold it for 3% less than it cost me; bought it back again and paid 3% more than I sold it for. I lost \$12 by the operation. What did the article cost me at first?

By A. L. FOOTE, *Hempstead, Long Island.*

Let the cost be \$ x , then he lost $\frac{3}{100}x$ and sold for $\frac{97}{100}x$. If he had bought it back at this price, he would have lost only $\frac{3}{100}x$, but he pays 3% more, or $\frac{3}{100}$ of $\frac{97}{100}x = \frac{291}{10000}x$, and the whole loss is $\frac{291}{10000}x + \frac{3}{100}x = \12 , whence $x = \$203\frac{1}{197}$.

By the PROPOSER.

Suppose the article cost \$100; then by selling and repurchasing, he has the article back and is out 3% of \$100, or \$3 in selling, and 3% of \$97, or \$2.91 in repurchasing; hence the entire loss is \$5.91, and to lose \$12, we have $5.91 : 12 :: 100 : \text{cost} = \203.05 , nearly.

Solutions furnished by LEISY, REED, GUNDER, HARVEY, WILEY, MCKIBBEN and PROPOSER.

778. *By J. R. BALDWIN, Blue Grass, Iowa.*—If a stright stick six inches long be dropped at random on a floor, which is ruled with parallel lines six inches apart; what is the probability of it falling on a line?

By HENRY GUNDER, *New Castle, Ind.*

Let $2a=6$ inches, and suppose the center of the stick to fall on a perpendicular between two of the parallel lines. This detracts nothing from the generality of the problem and renders its solution more simple. Now let x = the distance of the center of stick from the nearer of two parallels, and let θ = the angle made by stick with the perpendicular spoken of above. Then, it is easily seen that the required chance is

$$\frac{2}{a\pi} \int_0^{\frac{\pi}{2}} \theta dx = \frac{2}{a\pi} \int_0^{\frac{\pi}{2}} \theta \sin \theta d\theta = \frac{2}{\pi},$$

Where $a \cos \theta = x$. For a similar problem and solution, see Todhunter's *Integral Calculus*, page 318.

Elegantly solved by Artemas Martin and William Hoover. Mr. Martin used a diagram in his solution, but we think it is sufficiently clear as Mr. Gunder describes the supposed position of the stick.

ANOTHER SOLUTION OF PROBLEM 710, P. 119.

By S. G. CAGWIN, *New London, N. Y.*

This is a fine problem; one on Indeterminate Analysis, to which there are only two possible sets of answers. Perhaps a few words of explanation of the phraseology of the problem would be as useful as the solution. It seems that when A , B and C met for dinner the first time, B had twice as many dimes as A , and C twice as many as B . So if we let $x=A$'s number of dimes, $2x=B$'s and $4x=C$'s, and the total number of dimes is $7x$.

The problem by conditions in first line requires the value of $\frac{7}{100}x$, or the number of eagles in $7x$ dimes. Now, C paid for the dinners of all at the rate of 20 dimes per day for a certain *even number* of days as per 8th line. Let $2y$ =this even number; then the number of eagles they will have remaining after C pays from his purse alone the cost of the dinners for $2y$ days, will be $(7x-40y) \div 100=3$, as per 9th line. The integral values of x and $2y$ that will satisfy this equation, we find are contained in the series, $x=60, 100, 140, 180$, etc., and $2y=6, 20, 34, 48$, etc. Taking the first and second sets of values for x and $2y$, we have $\frac{7}{100}x=4.2$ or 7 eagles. None of the further higher values of x and $2y$ are admissible, as may be easily shown.

DIOPHANTINE ANALYSIS.

By HON. JOSIAH H. DRUMMOND, *Portland, Me.*

In solving questions in "Diophantine Analysis," we often have the expressions $2p \div (p^2-2)$, $(p^2+2) \div (p^2-2)$, and $2q \div (p^2-2)$, for which we desire integral values: as $(p^2+2) \div (p^2-2) = 2p \div (p^2-2) + 1$, if one is integral the other is; and if $2 \div (p^2-2)$ is integral, $2q \div (p^2-2)$ will be so when q is also integral; again when p is not integral and $2 \div (p^2-2)$ is integral, it is evident that $2p \div (p^2-2)$ will be integral, for, in the resulting compound fraction, the *lower* denominator will be the square of the upper denominator. So if we make $2p \div (p^2-2)$ integral, all three expressions will be integral.

The values of this expression are always in pairs of equal numbers but with opposite signs, and arising from different values of p ; and the law is very curious. If $p = a \div b$ give an integral value, then $p = 2b \div a$ gives an equal value with the opposite sign; if $a \div b$ and $2b \div a$ are values of p , which give a pair of values, then $(a+2b) \div (a+b)$ will be a value of p , which will give another integral value, and $2(a+b) \div (a+2b)$ will be the value of p , which gives the other

value in the same pair with the opposite sign, and so on *ad infinitum*. To prove the first of these propositions; take $p = a \div b$ and the expression becomes $2ab \div (a^2 - 2b^2)$; now take $p = 2b \div a$ and the expression becomes $2ab \div (2b^2 - a^2)$, or $-2ab \div (a^2 - 2b^2)$; $\therefore$ if the first is integral the second is. Now take $p = (a + 2b) \div (a + b)$ and the expression reduces to $2(a + b)(a + 2b) \div (2b^2 - a^2)$.

Application: $p = \frac{1}{1}, \frac{2}{1}, \frac{3}{2}, \frac{4}{3}, \frac{5}{3}, \frac{10}{7}, \frac{17}{12}, \frac{24}{17}$, etc.

Starting with $p = 1$, $2b^2 - a^2$, and $a^2 - 2b^2$, are each in all cases $= \pm 1$, or ± 2 ; so that $2 \div (p^2 - 2)$ will be the whole number.

Problems for Solution.

801. By J. C. ROEBUCK, *Rock Falls, Iowa*.—Find three numbers such that the sum of any two, and also the difference of any two, shall be a square number.

802. By L. G. KUHN, *Strasburg, Ohio*.—How many cubic feet in a stone 32 feet high, whose base is a rectangle 10 feet by 4 feet, and also the top, 8 feet by $1\frac{1}{2}$ feet?

803. By A. J. LILLY, *Dixon, Ill.*—Two parallel planes divide a sphere whose diameter is 36 inches, into three equal segments; required the altitude of each.

804. What is the longest strip of carpet one yard wide, that can be laid in a room 30 feet by 20 feet?

805. By H. L. HARVEY, *Maxfield, Me.*—Required the duration of twilight at 45° north latitude, Dec. 21.

806. By WM. WILEY, *Detroit, Mich.*—Find the integral right triangle whose area is times the sum of its sides.

807. By PROF. H. A. WOOD, *New York City*.—If the sun is 20° above the horizon, how high must a person ascend in a balloon to see a rainbow form a complete circle?

808. By PROF. DE VOLSON WOOD, *Hoboken, N. J.*—A body is free to rotate about its horizontal axis of symmetry, in a circular groove of which is wound a fine string, the free end of which is h feet below the tangent point of the string. An animal whose mass is m starts at the free end and crawls up the string at a uniform rate relatively to the string; required the rate so that he will just reach the tangent point, and how far below it will he be at the end of a given time?

809. By J. C. CORBIN, *Little Rock, Ark.*—A circle is inscribed in an isosceles triangle, whose altitude is one-half its base. Prove, that the radius of the circle, divided by the altitude of the triangle, equals the fractional part of $\sqrt{2}$.

810. By PROF. WM. HOOVER, *Athens, Ohio*.—If v be the vertical angle of any plane triangle, a , the sum of including sides, and b , the base, show that the sines of the angles at the base are to each other as

$$a - \sqrt{[b^2 - (a^2 - b^2)\tan^2 \frac{1}{2}v]} : a + \sqrt{[b^2 - (a^2 - b^2)\tan^2 \frac{1}{2}v]}.$$

811. By J. W. JONES, *Circleville, Ohio*.—A body weighing 5 lb. descend's vertically, and draws a weight of 6 lb. up an inclined plane of 45° . How far will the first body descend in ten seconds?

812. By S. G. CAGWIN, *New London, N. Y.*—In the latitude of 30° and 50° north, on the same meridian, in the morning of June 21, it is required to determine the exact instant when the sun's altitude will be equal, if observed at both places and find the altitude at that time.

Solutions should be received on or before Nov. 5, 1885.

Examination Questions.

ARITHMETIC.

1. Name and define all the different kinds of numbers.

ANS.—There are three fundamental classes or kinds of numbers; viz., *Integers, Fractions, and Denominate*. Then again we have *Abstract and Concrete numbers*. For definitions see text-book or Brooks's *Philosophy of Arithmetic*.

2. (a) $4+15\div 3+3=\text{what?}$ (b) $50\div 10+1\div 2=\text{what?}$

ANS.—We have for (a) $4+5+3=12$, and for (b) $5+\frac{1}{2}=5\frac{1}{2}$.

3. What per cent of a pound Avoirdupois is a pound Troy?

ANS.—The required rate is $5760\times 100\div 7000=82\frac{2}{3}\%$.

4. How much can I get at bank for my note for \$500, drawn at 90 days, money being worth 8%?

ANS.—The discount on \$1 for 93 days at 8% is $\$.02\frac{1}{3}$, and the proceeds are $\$.97\frac{1}{3}$; hence $500\times .97\frac{1}{3}=\$489.66\frac{2}{3}$, the sum I would receive in Ohio, but not so much in Pa. and a few other states, where bankers use four days grace.

5. A boy bought 30 oranges; for $\frac{2}{3}$ of them he paid 3 cents for 2, and for the remainder 2 cents for 3; for how much must he sell them apiece to gain 50%?

ANS.—He paid $20\times 1\frac{1}{2}+10\times \frac{2}{3}=36\frac{2}{3}$ cents, and to gain 50%, or half the cost, he must sell them for $36\frac{2}{3}+18\frac{1}{3}=55$ cents, which is $55\div 30=1\frac{5}{6}$ cents apiece.

6. At what time between 4 and 5 o'clock is the minute hand midway between 12 and the hour hand?

ANS.—At 4 o'clock the hands are at 12 and 4 respectively, 20 minute-spaces apart. At the required time the hour-hand is a certain distance past 4, which we designate *one space*; then the minute-hand is 10 minute-spaces + $\frac{1}{2}$ space past 12. It is a well-known fact that while the hour-hand moves *one space* the minute-hand moves 12 spaces; $\therefore$ 12 spaces = 10 minute-spaces + $\frac{1}{2}$ space, or $11\frac{1}{2}$ spaces = 10 minute-spaces, *one space* = $10\div 11\frac{1}{2}$, or $\frac{20}{23}$ minute-space, the distance the hour-hand is past 4, and the distance the minute-hand moved from 12 must be $12\times \frac{20}{23}$, or $10\frac{10}{23}$ minute-spaces, which marks the time at $10\frac{10}{23}$ minutes past 4. But the minute-hand may be past the hour-hand and midway between it and 12. Let *one space* (not same length as before, we shall see) = the distance hour-hand is past 4, then the minute-hand must be 40 min.-spaces + $\frac{1}{2}$ space past 12; $\therefore$ 12 spaces = 40 minute-spaces + $\frac{1}{2}$ space, or $11\frac{1}{2}$ spaces = 40 minute-spaces and the time indicated is $12\times (40\div 11\frac{1}{2})=41\frac{1}{3}$ min. past 4.

7. If $\frac{2}{3}$ of A's sheep, plus $\frac{3}{4}$ of B's number, equals 900, how many sheep has each, provided $\frac{3}{4}$ of B's number is twice $\frac{2}{3}$ of A's number?

ANS.—By last condition B's portion is twice A's; $\therefore$ B's portion is $\frac{2}{3}$ of 900 = 600, and his number, $600\div \frac{3}{4}=800$; and A's number is $(\frac{2}{3}$ of 900) $\div \frac{2}{3}=450$.

8. What is the length of the longest measure that can be exactly contained in each of the two distances, $18\frac{2}{3}$ feet and $57\frac{1}{2}$ feet?

ANS.—The G. C. D. of $18\frac{2}{3}$ and $57\frac{1}{2}$ is $2\frac{3}{10}$, which is length of measure in feet.

9. How wide must a man make a door-way which is 7 feet high, so that a circular saw 8 feet in diameter will just pass through?

ANS.—The width required is $\sqrt{(8^2-7^2)}=\sqrt{15}=3.8729833$ feet.

10. A block having 6 equal faces, contains 42875 cubic inches; how much will it cost to cover it on all sides with cloth worth 75 cents per square yard?

ANS.—The edge of cube is $\sqrt[3]{42875}=35$ in.; whole area, $35^2\times 6=7350$ sq. in. and the cost is $(7350\div 144\div 9)\times .75=\4.25 .

GRAMMAR.

1. What is grammar? What is English grammar? What is Latin grammar?

Ans.—Grammar as a *science*, is a system of principles common to all languages. These principles relate to *sounds, letters, syllables, words and sentences*. Grammar as an *art*, is a system of rules for the practical application of the principles to language. Hence English grammar is devoted to the facts peculiar to the English language, and Latin grammar to those of the Latin language.

2. What is a passive verb, and how is it formed?

Ans.—The so-called *passive* verb is simply a transitive verb, with the form of the passive voice. It is formed by adding the verb *to be* or one of its inflections to the perfect participle of a transitive verb.

3. Write a synopsis of the verb *teach* in the active and the passive voices, and indicative and potential modes.

INDICATIVE		POTENTIAL	
Active Voice	Passive Voice	Active Voice	Passive Voice
I teach	I am taught	I must teach	I must be taught
I have taught	I have been taught	I must have tau't	I must h've been tau't
I taught	I was taught	I should teach	I should be taught
I had taught	I had been taught	I should h've tau't	I should h've been tau't
I shall teach	I shall be taught		
I shall have tau't	I sh'll h've been tau't		

4. Give the corresponding masculine or feminine gender of each of the following words: Beau, confidant, queen, lady, administrator, poet, Jew.

Ans.—Beau, belle; confidant, confidante; king, queen; lord, lady; administrator, administratrix; poet, poetess; Jew, Jewess.

5. Correct if wrong: Do you know whom you saw. Do you know it to be him.

Ans.—They are correct, with the exception of the interrogation point, which should be placed after each sentence.

6. What kind of elements do infinitives make?

Ans.—Essential, attendant, adjective, and adverbial.

7. Give the construction of the infinitives in the following sentences: I came to hear. I try to learn. I want him to go.

Ans.—(1) Adverb. (2) Adverb, *try* being an intransitive verb. (3) Adjective.

8. What is an idiom? Give examples.

Ans.—A peculiar form of expression; as, *to cave in, to flare up*, A man's a man for *ae* that.

9. Scan the following, state what kind of stanza it is, and parse italicized words:

O, all ye *people*, clap your hands,
And with triumphant voices sing;
 No *force* the mighty power withstands
Of God, the universal king.

Ans.—It is iambic tetrameter—two syllables in a foot, with the accent on the second, and four feet in a line.

People is a common noun, of the common gender, third person, plural number, and in apposition with *ye*.

And is a co-ordinate conjunction; it connects the two imperative sentences.

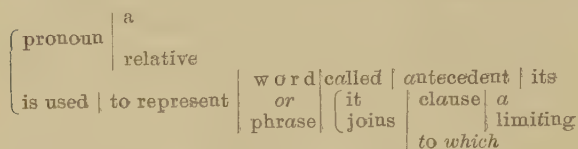
With is a preposition, showing the relation between *sing* and *voices*.

Force is a common noun, of the neuter gender, third person, singular number, and in the nominative case, subject of *withstands*.

Of shows the relation of *God* to *power*.

10. A *relative pronoun* is used to represent a preceding word or phrase, called its *antecedent*, to which it joins a limiting clause.

Parse italicized words, and analyze or diagram 10th.



Parsing is easy from diagram.

ORTHOGRAPHY.

1. Define orthography.

Ans.—From the Greek *orthos*, right, and *graphie*, writing, it signifies correct writing or spelling of words by means of letters.

2. What is a syllable? a word?

Ans.—A *syllable* is a certain combination of phonetic elements pronounced by a single impulse of the voice. A *word* is the sign of an idea.

3. How are elementary sounds produced?

Ans.—By action of the vocal chords set in motion by a stream of air gushing from the lungs.

4. How are elementary sounds modified?

Ans.—By the organs of speech.

5. Name the classes of elementary sounds.

Ans.—Vowel sounds or vocals, and consonant sounds or subvocals and aspirates. Brutes utter the former, and man only can utter the latter.

6. What are palate sounds? Give examples.

Ans.—Consonantal sounds formed by means of the palate; as, that of *k*, *g*, *l*, *r*.

7. What is the last subvocal in the alphabet?

Ans.—It is the last letter of the alphabet.

8. When is *y* a consonant and when a vowel?

Ans.—When it is equivalent to *u* or *i*, it is a vowel; otherwise a consonant. Or, it is a consonant when a vowel follows it in the same syllable, and in other situations it is a vowel.

9. What are double consonants?

Ans.—Two consonants forming one elementary sound.

10. Give three rules for spelling.

Ans.—I. Monosyllables ending in *f*, *l* or *s*, preceded by a single vowel, double the final consonant.

II. Monosyllables and words accented on the last syllable, when they end with a single consonant preceded by a single vowel, double their final consonant before a suffix that begins with a vowel.

III. When a termination is added to a word ending in *y*, preceded by a consonant, *y* is changed to *i*, except when the termination *ing* is added.

GEOGRAPHY.

1. Why are the polar circles so located?

Ans.—On account of the inclination of the earth's axis.

2. Name the states of Central America and capital of each.

Ans.—Guatemala, N. Guatemala; Honduras, Tegucigalpa; San Salvador, San Salvador; Nicaragua, Managua; Costa Rica, San Jose.

3. Which coast of the U. S. has the warmest climate? Why?

Ans.—The western coast has the warmer climate, because of oceanic currents and prevalent winds.

4. Name the summer months of the south temperate zone.

Ans.—The same as our winter months—Dec. Jan. and Feb.

5. Bound Switzerland. For what is it noted?

Ans.—It is noted for its fine sceneries and its widely diffused elementary instruction.

6. Name in the order of their size the grand divisions, the oceans and the five largest cities of the U. S.

Ans.—Asia, Africa, North and South America, Europe. Pacific, Atlantic, Indian, Arctic and Antarctic. New York, Philadelphia, Brooklyn, Chicago, and Boston.

7. Define the following: everglades, geysers, monsoon, climate, and tundra.

Ans.—The *Everglades* resemble a large lake dotted with islands, in southern Florida, 160×60 miles. The depth of water varies from one to six feet, and one place is within half a mile of the ocean. About 300 Seminoles live here. *Geysers* are eruptive thermal springs or wells, in evident connection with volcanic forces within. They are found in various parts of the earth, the best known being in Iceland, but the most wonderful are in the Yellowstone region. *Monsoons* are constant winds near all southern and western coasts, blowing in one direction for six months, and then for six months in the opposite direction. *Climate* is the condition of a country with respect to heat and moisture. The steppes of Asia bordering the Arctic ocean are usually called *Tundras*.

8. Name the river systems of the U. S.

Ans.—The Mississippi, and the St. Lawrence, taking *river-system* to mean any great river with all its tributaries.

9. Name the five principal classes of mineral springs.

Ans.—Calcareous, soda, silicious, sulphur and chalybeate.

10. What and where are the following: Comorin, Tanganyika, Tananarivo, St. Elias, and Teheran.

Ans.—*Comorin* is a cape at the southern point of Hindoostan; *Tanganyika* is a lake in Africa; *Tananarivo* is the capital of Madagascar; *St. Elias* is a peak of the Coast Mts. in N. America, 17,900 ft. high; *Teheran* is the capital of Persia.

HISTORY.

1. Describe the first permanent English settlement in America.

Ans.—Jamestown, Va., was founded by 105 persons, May 13, 1607, who came from England under the auspices of the London Co. They named the town and river in honor of the King, the capes at the ocean, Charles and Henry, in honor of the King's sons, and the deep water for anchorages "which put the

emigrants in good comfort," Point Comfort. There were few laborers and no families. Christopher Newport, the captain of the vessel, returned to England in a month, and disunion, suffering and death followed. Fifty persons, including Gosnold, died that summer. Capt. John Smith left on his exploring expedition in December.

2. What is meant by the Mason and Dixon's line?

Ans.—The line drawn by Chas. Mason and Jeremiah Dixon, two eminent English mathematicians, along the parallel $39^{\circ} 43' 26.2''$ which became the permanent boundary line between Pa. and Md., to settle dissensions between the Lord-Baltimore and Penn families. The survey was commenced in 1760, but the London proprietors became impatient with the delay, not knowing the country. Mason & Dixon were sent in December, 1763, to complete the work, and in 1767 they had all done except 36 mi., which Col. Alex. McLean and Jos. Neville finished in 1782.

3. What was the Stamp Act? Mutiny Act? The Boston Port Bill?

Ans.—The *Stamp Act* passed Parliament February 27, 1765, signed by George III., March 22, and became a law Nov. 1, but it never went into effect. It provided that legal documents must be written on paper bearing a stamp, bought of tax collectors; that newspapers and pamphlets and even the advertisements therein, were to be taxed.

The *Mutiny Act* was an "Annual Act of Parliament for punishing Mutiny and Desertion and for the better payment of the Army and their Quarters," which had been applied to America, in order to quarter troops in cities during the stamp-act excitement.

The *Boston Port Bill*, having passed Parliament, was signed by the king Mar. 31, 1774, and went into effect June 1. It shut out all commerce from Boston, and the government offices were ordered to be removed to Salem. You remember how thoroughly Gen. Gage executed this bill.

4. Into what departments is the government of the U. S. divided? Give the duty of each.

Ans.—The *Legislative* to make the laws, the *Judicial* to expound them, and the *Executive* to execute them.

5. Give the term of office and salary of President, Vice-President, U. S. Senator and U. S. Representative.

Ans.—President for a term of 4 years, commencing at noon, March 4th, at \$50,000 a year and free residence, or nearly \$160 a day; the Vice President's term is the same, and gets \$8,000 a year; Senators for 6 years, at \$5,000, with mileage (20), Stationary (\$125), and expenses on committess, etc.; Representatives for 2 years at \$5000, with mileage, etc., same as Senators.

6. Who was Wolfe? Montcalm? In what war engaged? In what battle killed?

Ans.—James Wolfe was a celebrated English officer, born in Kent, 1726. He served with distinction in Germany (seven year's war) and had a part in the capture of Louisburg from the French in 1758. He succeeded in climbing the Heights of Abraham and gained a decisive victory at the time of his death, Sept. 14, 1759.

Montcalm was a French general, born near Nimes in 1712. He served in several campaigns in France and the Netherlands, and was sent in 1756 to defend the French colonies in America. He was mortally wounded in the great battle on the Plains of Abraham, and died the next morning.

Today a monument stands in the "Governor's Garden" in Quebec, equally commemorating the bravery of these two representative soldiers.

7. Name the political parties that have been organized in the U. S.

ANS.—In early colonial times—*Whigs* and *Tories*, adherents of same parties in England, and the first vital issue of these parties in what is now the U. S., took place when the "Stamp Act" was passed. The great mass of the colonists suddenly became extreme whigs, while most of the governors, their subordinates, their social coteries, and a few of the people, such as we would now call *fossils*, clung to Toryism and the "Divine rights of Kings." The Declaration of Independence, July 4, 1776, and the Articles of Confederation and Perpetual Union of July 9, 1778, destroyed political parties in America. The debates in the constitutional convention formulated two new political parties—the Federalists and the Anti-Federalists; the latter assumed the name Republicans, about 1791. The "Missouri Compromise" and the "era of good feeling" that followed, in which Clay and Monroe were the heroes, entirely destroyed the Federalists as a party, and in the election of 1824, 99 electoral votes were cast for Andrew Jackson, 84 for John Quincy Adams, 41 for Wm. H. Crawford and 37 for Henry Clay. The long and sanguinary debate in the House of representative concerning the "Clay and Adams" faction as it was called, and Mr. Adam's appointment of Clay as Secretary of state, so intensified the indignation of opponents, that two well-defined parties sprung from the Republican stem. Adams was the leader of the new party then styled National Republicans. Jackson was the champion of the old trunk of the party that dated its patent as an inheritance from Jefferson, and this party now gloried in the name of Democrats. Then came the Anti-Masons in 1826, which died in the presidential struggle of 1832. In 1836, the National Republicans came out as Whigs, among whom were Anti-Masons and Abolitionists, the latter arising from the question of slavery in Texas, and organized into a Liberty Party in the Anti-slavery convention at Albany, April 1, 1840. This party did not succeed, but the slavery question attending the organization of California and New Mexico, was the germ that produced the Free Soilers, who held their national convention at Buffalo, Aug. 9, 1848, and lived through a second administration. At the close of Pierce's administration, the Whig party was visible only in factions, and all parties except the Democrats united under the name of Republicans in the campaign of 1856, and the two great parties of to-day then started out together in that canvass. The Know Nothing Party came out in 1860, the Liberal Republicans, the National Christian Association, and the Prohibition Party, in 1872, the last two coming up in 1876, the last still exists.

8. What was the Monroe Doctrine?

ANS.—That we should consider any attempt on the part of European powers to extend their system to any portion of this hemisphere as dangerous to our peace and safety, and that we could not view any interposition for the purpose of oppressing or controlling American governments or provinces in any other light than as a manifestation by European powers of an unfriendly disposition toward the United States.

9. How is the Governor of a territory placed in office?

ANS.—By appointment of the President of the U. S., and when a territory has a sufficient population to send a representative to Congress, it is entitled to admission into the union as a state.

10. Name and give date of death of two men who held the office of President and who died on the same day.

ANS.—John Adams and Thos. Jefferson, July 4, 1826.

The attention of our home subscribers is respectively called to the fullness of these answers, and you will favor us by recommending the *Visitor* to those among us who are not taking it. How does this disposition of the lists suit you?

ENGLISH GRAMMAR.

Answers to Queries.

1. Parse— *My going* to school there will depend on the *directors' giving* their *consent*.

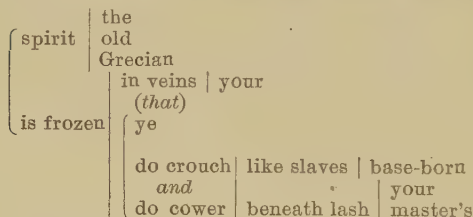
Ans.—*My* is a simple personal pronoun; it has no antecedent, expressed but it shows by its form that it is of the common gender, first person, singular number, and in the possessive case, possessing *going*.

Going is a present participle with the construction of a noun, nominative case, subject of *will depend*.

Directors is a common noun, of the masculine gender, third person, plural number, possessive case; it possesses *giving*.

Giving is a present participle, object of *on*, and governs the noun *consent* in the objective case.

2. Diagram.—Is the old Grecian spirit frozen in your veins, that ye do crouch and cower like base-born slaves beneath your master's lash?



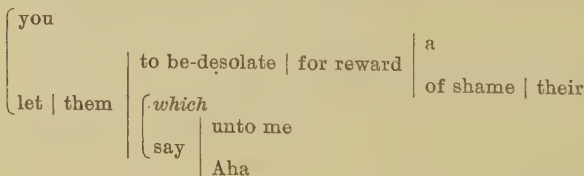
Beneath does not show the relation between *slaves* and *lash*, for it is not *slaves* beneath lash, but *crouch* and *cower* beneath lash. The antecedent term of the relation expressed by a preposition can easily be determined when the right method is employed. See examples on the next page.

3. Diagram.—No quips, now, pistol: I am in the waist two yards about.



The meaning of this expression seems to harmonize with the above disposition of its elements.

4. Diagram.—Let them be desolate for a reward of their shame which say unto me, Aha! aha!



5. What are the leading benefits to be derived from the study of grammar? PATER.

Ans.—The source of this query enlists attention, and we are compelled to say that the study of grammar, as pursued by many pupils, is almost entirely useless. It is absurd to suppose that the teaching of parsing, analysis, and a little syntax can develop sufficient ability in regard to language or thought. Grammar is taught too much as a thing separate from invention, thought and practical use. There is too much cramming and not enough of mental digestion and assimilation. The pupil should learn merely the accidents of the science and then practice the *art* of expression. He should be required to illustrate by *original* examples every rule or principle involved in the lesson, and in the study of syntax he should have ample exercises in which his own language is presented for criticism and correction. What is the use of taking a pupil through grammar, and in the end find that his language is no better than when he began the study? Do not understand that we would discard the study of grammar. We have it in our curriculum, but a thorough *language culture* in which the pupil is led to originate thought and expression, forms the leading feature in the study. Our chief aim is to develop the power of wielding thought to the best advantage. Pupils give often some of the most noble expressions, embracing the advantages of force and elegance, which we regard of far more value than the ability to analyze or parse difficult examples. Teachers, let us strive to have better language in school and spend less time with technical grammar.

6. How do you tell the antecedent term of the relation shown by a preposition? S.

Ans.—It is easily done. In the sentence you gave, *He shakes the woods on the mountain side*, we say—What on mountain side? It is not *shakes* but *woods* on mountain side; hence *woods* is the antecedent term of the relation shown by *on*. Again, in “John acted *agreeably* to your commands”, *agreeably* and not *acted*, is the antecedent term. Likewise in the following examples the terms of relation are italicized.

EXAMPLES.—The problem is too *difficult* for you. I can make no *diminution* of my tuition *rates*. When *shall it be* well with thee? Silently moved the *crowd* before *him*. Samuel attended school two *quarters* of nights. I gave you the methods by *which* to solve the problem, There *was* a noise at my *door*.

7. How would you dispose of “Fare thee well”? Id.

Ans.—It can not be parsed by the rules of modern grammars, though it is good English. The sentence is of Anglo-Saxon origin, (*faran*, to go) and may be expressed in words that can be parsed—“May it go well with thee.”

8. Parse italicized words: *Not only* his property, *but even* his life was at stake.

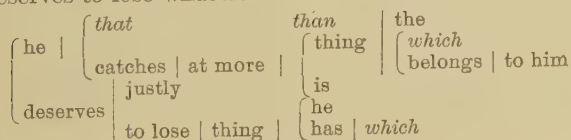
Ans.—*Not* is a negative adverb, modifying *only*, perhaps, or the phrase *his property only*.

Only is an adjective and belongs to *property*, in the sense of *alone*.

But is a conjunction; it connects the two correlative sentences.

Even is an adverb, modifies the phrase *his life was at stake*, with special reference to *life*.

9. Diagram.—He that catches at more than belongs to him, justly deserves to lose what he has.



MISCELLANEOUS DEPARTMENT.

Answers to Queries.

NOTE.—After the following pages were printed, we received a set of answers from Prof. H. A. Wood, several of which we take pleasure in publishing on this page. He sent a full and interesting answer to query 718, but the answers given on pages 198-9 are excellent. This department contains matter that is highly valuable to the student and teacher, and we trust all are interested.

705. Fortune, like the rest of her sex, favors the young and neglects the old," were the words of what emperor? *Id.*

Ans.—In the war between Henry II. of France and Charles the V. of Germany, Henry sought to maintain the idea of every Frenchman that the natural boundary of France on the east is the Rhine. To realize this idea he took forcible possession of Toul, Verdun, and Metz. Charles laid siege to Metz with an army of 100,000 men. The knights of France flocked to the rescue of Francis, Duke of Guise, who defended the city. The emperor was forced to retire, bitterly declaring that "Fortune, like the rest of her sex, favors the young and neglects the old." Three years afterward he retired to a monastery, and his immense kingdom was divided between his son, Philip II., and his brother Ferdinand.

H. A. Wood.

717. Why is the capital of Holland called "The Hague"? Give origin of the name of Brandywine creek, a scene of the Revolution.

Ans.—Hague, the capital of Holland, owes its origin to a country-seat which was built there by the counts of Holland in 1250. It derives its name from *Gravenhaag*, meaning count's hedge, from which it has come to be known as "The Hague". According to De Vere, Brandywine creek was so named by the German settlers from "Brauntwein." Why it was so called he does not state.

H. A. Wood.

576. Give the author of the following expressions: (a) "Young man, your discourse resembles the Cypress, which is tall and spreading, but bears no fruit," and (b) "And for my part I will make this a happy day for the Romans."

VAL. HARTMAN.

Ans.—The first quotation is the language of Phocion to Leosthenes. The last we are unable to place.

EDITOR.

700. Describe the Sirenia or Sea Cows, and tell where they are found.

L. B.

Ans.—The name of *Sirenia* is chiefly owing to the peculiar form and habits of the Dugong, which has a curious custom of swimming with its head and neck above the water, and bears some grotesque resemblance to the human form, and might have given rise to the poetical tales of mermaids and sirens which have prevailed in Eastern climes. When the female Dugong is nursing her child, she carries it in one arm, and takes care to keep the head of her offspring, as well as her own, above water, and thus presents a strangely human aspect. They do nothing but eat and sleep, the sexes display great mutual affection, and the female is a devoted mother, clasping her little one to her bosom in times of danger, often shedding copious tears and uttering a weak, dull moan, which somewhat resembles that of a human being in pain. The old Greek writer Megasthenes speaks of creatures in the Indian seas which resemble women; an early Portuguese surgeon professes to have dissected a "mermaid"; and the Dutch traveler Valentyn describes "sea-wives"; in all these cases one of the species of this animal is doubtless meant.—*Johnson's Household Book of Nature*.

EDITOR.

Credit to C. A. Sebring, Charles Bigler, Ed. Rynearson, John H. Kniesly, and J. H. W. Schmidt for excellent answers.

Ans.—The order of the Sirenia is represented by two families, the Trichechidæ, and Halicoridæ; the former include the manitees, or “sea cows”, the latter the dugongs. The manatee is a genus of herbivorous marine animals, its external features resembling the order Cetacea, while the internal structure places them among the Pachydermata. Three species are known, the Mexican sea-cow found in Florida, on the Mexican shores, and in the West Indies; the lamantin of the western coast of Africa; and the *Manatus australis* of the tropical portions of South America. The adult manatee sometimes exceeds nine feet in length. It has a tough hide resembling the pachyderms. The posterior extremity is flattened horizontally, and constitutes a very large portion of the whole body. It has thirty-two molar teeth. All members of the family are vegetable eaters, and are frequently mentioned as herbivorous Cetacea. He is able by means of his flippers, which are provided with stout nails, to climb on shore and browse on the plants growing near the water. A specimen of the *Manatus latirostis* was kept alive at the Central Park Zoological Gardens, N. Y., during the summer, but the cold season proved too severe for it. This one weighed 450 pounds, and was nearly seven feet long, circumference four ft. and nine inches. It readily responded to the call of its keeper. It ate its food under water. It usually remained under water five or six minutes. Mr. Chas. Lanman describes a fight between the Mexican sea-cow and a jaguar. The latter was so furiously beaten by the tail of the manatee that it was soon disabled and crushed underneath the huge form until its back was broken. The length of this sea-cow was eighteen feet.

H. A. WOOD

701. Give a sketch of the author of “Rock Me to Sleep, Mother.

Ans.—*Rock Me to Sleep, Mother*, was written by Mrs. Elizabeth Akers. She was born in Maine, Oct. 9, 1832, and first married Paul Benj. Akers, afterward E. M. Allen, of New York. Her poems were published in 1867.

J. K. P. SAYLER.

Elizabeth Akers Allen was born at Strong, Maine, in 1832, and passed her childhood amidst the picturesque scenery of that neighborhood. She lost her mother when very young, but inherited her grace and delicacy of thought. Shortly after her mother's death, her father removed to Farmington, Maine, a town noted for its literary people. Mrs. Allen's early pieces appeared over the pseudonym of “Florence Percy.” Her first verses appeared when she was twelve years old; and her first volume, entitled *Forest Buds from the Woods of Maine*, was published in 1856. For some years she was assistant editor of the *Portland Transcript*. The poem, entitled *Rock Me to Sleep, Mother*, was claimed by five different persons, who attempted to steal the honor of its composition.

JOHN KNIESLY.

702. What was the “Battle of the Spurs? The “Second Battle of the Spurs”? The “Battle of the Brothers”? Why so called?

Ans.—Philip the Fourth, known in history as “Philip the Fair” ascended the throne of France at the age of seventeen. He was haughty, proud, and unscrupulous in character. Philip coveted the rich lands of Flanders, sent an army into the country and subdued it. The people irritated beyond measure by taxes, forced contributions, and the insolence of their masters, rose in revolt. Philip once more ordered his army into Flanders. The armies met under the walls of Courtrai. On one side were 50,000 disciplined soldiers; on the other 20,000 Flemish weavers and traders. The French horsemen, disdaining to first reconnoitre the ground, charged at full gallop, but fell headlong into a ditch in front of the Flemish lines. The sturdy weavers plied their staves upon the floundering mass. The flower of the French chivalry lay crushed and bleeding in the ditches and on the field. Four thousand, some say seven thousand, gilt spurs were picked up, and hung in the cathedral of Courtrai. Hence this contest has become known in history as “The First Battle of the Spurs.”

The ambitious conquests of Louis XII., of France, had leagued against him several nations, which finally forced him to look to the defence of France itself. His country was threatened on the east by the Swiss, on the south by the Spaniards, and on the north by the English. The latter won the battle of Winegate, near Calais, in 1513. This is known as the second 'Battle of the Spurs, not, as at Courtrai, because of the number taken from the dead, but because of the good use made of them by the French cavalry, who plied them lustily in ignominious flight.

Louis, son of Charlemagne, known as Louis the Good-Natured, left three sons. His amiability was not only lost on his wild Frankish warriors, but had ruined the discipline of his own household. The great name of Emperor fell to Lothaire, the eldest son. The other brothers, Charles and Louis, refused submission, rallied their forces, and a terrible battle was fought, in which 100,000 men are said to have perished. This battle was fought at Fontenay, 841, and is known in history as the "Rattle of the Brothers." The flower of the Franks fell on that disastrous day.

H. A. Wood.

Answered by Ed. Ryneerson, J. H. W. Schmidt, and A. L. Foote.

703. Who founded the University of Paris? The Royal Library of Paris? Id.

Ans.—Charles V., called "the Wise," a cold, prudent, sickly prince, in 1350, laid the foundation of the great Royal Library of France, by placing 900 MSS, in three chambers in the Louvre. That library is the largest in the world, containing over 2,000,000 volumes.

To Abelard is due the mental reputation of Paris, which in its turn led on at the end of the 12th century to the establishment of the university of Paris, mother of all the learned corporations of modern Europe. Bonaparte, however, when he reorganized education, established the University proper. We can not now state who founded the old university.

EDITOR.

704. What was the "Day of the Herrings"? The "Treaty of the Merchants"? The "Ladies Peace"? Id.

Ans.—Charles VII., of France, ascended the throne in perilous times, Henry VI., of England, was proclaimed king at Paris. The south, however, remained faithful, but Charles, good-natured and indolent, was incapable of saving his country. The English termed him "King of Bourges" as he fixed his headquarters in that city. His affairs grew desperate, Orleans, the last refuge of Charles' party, was besieged and offered to surrender. The disastrous "Day of Herrings" seemed to give the final blow to his cause. This battle was fought by the French and Scotch on one side, who made a sally to intercept a convoy of salted herrings *en route* to the English camp for the use of the army during Lent. The barrels of fish were knocked to pieces by the artillery, and their contents scattered.

Between Louis XI., king of France, and Charles the Bold, Duke of Burgundy, a bitter enmity had sprung up. Charles, rash and impetuous, was no match for his cunning adversary. The affairs of the duke becoming somewhat desperate, he called the English to his aid. Edward IV., of England, crossed the channel with a fine army to help his brother-in-law, the duke, but Louis, ever shrewd and crafty, offered him to withdraw, 75,000 crowns down, an annual pension, and the dauphin as a husband to his daughter Elizabeth. These arguments were irresistible, and the English returned. The French called this peace the "Treaty of the Merchants."

Francis I., king of France, to whom Calvin dedicated the *Institutes of the Christian Religion*, carried on four disastrous wars with his rival, Charles V. During the second war the French, under Lautrec, made a triumphal entry in-

to Italy, but, as usual, it ended in disaster. Finally the treaty of Cambrai brought a lull in the conflict. This treaty was negotiated by Loise of France, mother of the king, and Margaret of Austria, the emperor's 'well-beloved aunt', and from this cause has been known in history as the "Ladies Peace".

H. A. Wood.

705. Fortune, like the rest of her sex, favors the young and neglects the old," were the words of what emperor? *Id.*

706. Why is water solidified (ice) able to float on water? *Id.*

Ans.—Water contracts in volume, with a diminution of its temperature, until reduced to 39.2° Fahr., where its density is greatest. Below this temperature it expands. On account of the expansion below 39.2° , the water near the freezing point floats on the surface, and ice forms there rather than in the depths. (See Guyot's Physical Geography).

WM. S. DAVIDSON.

In the formation of water into ice the latter gradually assumes the form of closed cells, resembling honey comb. These cells are full of air, the proportion of air in the ice being considerably greater than in the water, thus making the ice lighter than water and able to float.

H. A. Wood.

Answered by Henry Gunder and J. H. W. Schmidt.

707. From what height must a block of ice fall that the heat generated by the collision may be just able to melt it? *Id.*

Ans.—Before this can be answered we must know the temperature of the ice. Assuming its temperature x° Fahr., then since a mass of water falling a distance of 772 feet will have its temperature raised 1° Fahr., we have $(32-x) \times 772$ feet for the height. This supposes ice to have the same specific capacity for heat as water. If not, let s be spe. capacity of ice, water being one, then $s \times (32-x) \times 772$ feet.

HENRY GUNDER.

Let m = the mass of the ice, n = the number of degrees in temperature by which it is necessary to raise ice to melt it, g = the acceleration of gravity, d = density of ice, s = its specific heat, J = Joule's mechanical equivalent of heat, and h = the required distance. The work done by the ice in falling the distance $h = mgh$; putting w = the weight of a volume of water equal to that of the ice, we have by "Thermodynamics," $n = mgh + wsJ \dots (1)$. But $w = mgd + d$; hence (1) gives $h = Jns + d$.

WM. HOOVER.

NOTE.—In this answer and Mr. Hoover's answer to 708, J may be taken 772 feet, and g $32\frac{1}{2}$ feet.

Dr. Joule, of Manchester, England, by a series of careful experiments, discovered that a weight of one pound falling (*in vacuo*) 1390 feet into one pound of water would raise the temperature of the water one degree Centigrade. This is called 1390 foot-pounds, and is generally used as the mechanical equivalent of heat. The number of thermal, or heat units required to melt a pound of ice is eighty; hence the ice must fall $1390 \times 80 = 41760$ feet, nearly six miles.

H. A. Wood.

708. Determine the velocity with which a lead ball must strike a target that the heat generated by the concussion may be sufficient to fuse it? *Id.*

Ans.—Let v = the required velocity; then the work done is $\frac{1}{2}mv^2$, and if we use the notation of answer to query 707, noticing that we are now considering a mass of lead, $n = \frac{1}{2}mv^2 + wsJ = dv^2 + 2Jgs$, or $v = \sqrt{(2Jgsn + d)}$. WM. HOOVER.

Lead melts at 326° C. Consider that it falls as shown in the last query; if it start at 0° C, it must fall $1390 \times 326 = 453140$ feet to fuse it. Fro a falling body $r = \sqrt{(2gs)}$. If s 453140 ft., $r = 5399.26$ ft. or a little over a mile per second, the required velocity. In these two queries the bodies are supposed to fall *in vacuo*, and gravity to remain constant.

H. A. Wood.

The specific capacity of lead is $\frac{1}{30}$ that of water, and its melting point $+600^{\circ}\text{Fahr}$. Hence from 707 we have $\frac{1}{30} \times (600 - x) \times 772$ feet for the height through which the lead must fall to generate sufficient heat to fuse it. The velocity acquired in falling this height is $\sqrt{2g \times \frac{1}{30} \times (600 - x) \times 772}$. In query 707 and 708 I have supposed *all* the heat generated spent in raising the temperature of the falling body. This, however, will never be the case in practice, but part is communicated to the object on which the body falls. Also the retardation of the air must be counted as well as the heat communicated to it,
H. GUNDEL.

709. Some ants have wings; do such ants fly? JNO. GOTTSCHALL.

Ans.—Ants live in societies, often very large, which consist, as in bees, of *males, females* and *neuters*. The males and females constitute but a small portion of each community. They have delicate glistening wings; but the neuters have no wings, and the thorax is smaller and more compressed. The males are smaller than the females, and the workers are rather smaller than the males. The winged ants appear mostly in autumn, and perish before the commencement of cold weather; a few surviving to found new colonies and perpetuate the race. They are restrained from making their escape into the air until the pairing season, when they ascend into it in immense swarms, those from many ant hills sometimes uniting their myriads, rising with incredible velocity in distinct columns, and soaring to a great height. Each column looks like a kind of slender net-work, and has a tremulous undulating motion. The noise emitted by myriads and myriads of these creatures does not exceed the hum of a single wasp. The slightest zephyr disperses them.

Answered by W. S. Davidson.

J. H. W. SCHMIDT.

NOTE.—A species of ant is found in Asia and in the interior of Texas, that is said to plant, cultivate and gather a certain kind of grain upon the seeds of which it subsists.
EDITOR.

710. Give the origin of Thanksgiving.

HATTIE HARPER.

Ans.—The three annual feasts of the Jews were seasons of national thanksgiving. In this case their appointment and mode of observance were enjoined by their Maker. The more modern observances of a similar nature have probably grown out of this custom, having its origin in the gratitude of the heart to the great Creator. At the same time it keeps fresh in the memory the special cause of gratitude. The New England Thanksgiving dates back to the first year of the settlement of Massachusetts, Gov. Bradford appointed a day of Thanksgiving after the first harvest had been gathered in. It was a *week* instead of a *day* of Thanksgiving, the day of feast and religious exercises being Thursday.

H. A. WOOD.

Thanksgiving Day is chiefly an American institution. After the first harvest of the New England colonists in 1621 Gov. Bradford made provision for their rejoicing specially together with praise and prayer. In 1623 a day of fasting and prayer in the midst of drought was changed into thanksgiving by the coming of rain during the prayers; gradually the custom prevailed of appointing thanksgiving annually after harvest. These appointments were by proclamation of the governors of the several New England states. During the Revolution a day of national thanksgiving was annually recommended by Congress. Washington recommended such a day after the adoption of the constitution, and his example was occasionally imitated by subsequent presidents. During the Rebellion, Pres. Lincoln frequently recommended the observance of such a day after victories, and made a proclamation for a national observance in 1863. Since that time such a proclamation has been annually issued, and custom has fixed on the last Thursday of November as the time.

J. H. W. SCHMIDT.

Answered by C. A. Sebring; Ed. Ryneerson, A. L. Foote and Chas. Bigler.

NOTE.—Aug. 6, 1863 was a day set apart by Proclamation of Pres. Lincoln, for a national thanksgiving in gratitude for the turn of the war at Gettysburg.

711. Give date and particulars when an attacking party retreated on account of fire flies.

ED. RYNEARSON.

Ans.—In 1594, Sir Robert Dudley fitted out an expedition for plunder at his own expense against Spanish America, he sailed into West India waters and took Spanish vessels. It was on this trip or on one of Cavendish's just previous, that the English having landed at night upon a West India island for booty, saw an innumerable body of tropical fire-flies, and fancying that a large Spanish force with matchlocks was advancing upon them, fled to their boats in great fright, these fire-flies therefore saved the place or places against which the trip was planned.

CHAS. BIGLER.

Answered by Ed. Rynearson.

712. Locate and describe "The Boiling Mountain". *Id.*

The "Boiling Mountain" is a sobriquet for the volcano Pichincha, which, in 1566 hurled ashes and stones upon Quito, five miles away, to a depth of three feet. Boiling water and bitumen were emitted in floods. This volcano is 16,000 feet high, and has a crater 2,500 feet deep, the deepest crater on the globe.

ED. RYNEARSON.

713. About how many octaves does the whole range of human hearing, from the lowest note of the organ to the highest known cry of insects, include?

D. W. K.

Ans.—The lower limit of audible sounds is fixed at 16 vibrations per second. This was determined by experimenting with the instrument called siren. But to fix a high limit was a very difficult matter. Despretz made use of smaller and smaller tuning forks, and finally succeeded in demonstrating that there is an upper limit for sound, beyond which our ear perceives nothing. This limit was fixed by him at very nearly 38,000 vibrations in a second, a figure that has been finally confirmed by Helmholtz; but we are satisfied that it differs very much in different individuals. In the pianoforte of seven octaves, the lower sound (A) is produced by about $27\frac{1}{2}$ vibrations, and the highest (A) by 3840 vibrations per second. The limits of musical notes are about 27 and 4000, beyond either of which we have noise only.

EDITOR.

714. What were Stonewall Jackson's last words? *Id.*

Ans.—"Let us pass over the river, and rest under the shade of the trees."

J. K. P. SAYEER.

715. Is the "British Lion" a myth, or did the lion ever live in England?

L. M. O.

Ans.—The lion is the emblem of England and indicates sovereignty and power. The "British Lion," therefore, alludes to England. The French heralds call the lion passant (emblem of resolution) a leopard; hence Napoleon said to his soldiers, "Let us drive these leopards (*the English*) into the sea." The lion was not unfrequently found in southeastern Europe, but was never in England as a native. The English regard the lion which comes from British possessions as the type of the heraldic supporter which holds the shield of England, and is famous in the nurseries as having fought with the unicorn. EDITOR.

716. What is the "Curfew Law," and who originated it? *Id.*

Ans.—The Curfew Law was an observance said to have been introduced into England by William the Conqueror, that when the curfew bell was rung at eight in the evening, lights and fires should be extinguished. The custom existed in France, Spain, and other countries, but the strictness with which William I. compelled its observance, has caused its origin to be attributed to him. Henry I. in 1103 relaxed the stringency of this law. In the reigns of Edward I. and Edward III. persons were not permitted to be abroad in the city, armed, after curfew.

H. A. WOOD.

To William the Conqueror is ascribed the introduction of the Curfew bell into England, the object of which was to warn the people to cover up their fires, and retire to rest. The time for ringing these bells was sunset in summer, and about eight o'clock in winter; and certain penalties were imposed upon those who did not attend to the signal. The practice of ringing Curfew bell, however, appears to have prevailed throughout Europe long before the era of the Norman conquest, its object being the laudable one of preventing fires, which, owing to houses being chiefly built of wood, were then both frequent and destructive. The custom of ringing the Curfew bell is still continued in many parts of England, though its original significance is lost.

Answered by ED. RYNEARSON and A. L. FOOTE.

J. H. W. SCHMIDT.

717. Why is the capital of Holland called "The Hague"? Give origin of the name of Brandywine creek, the scene of a Revolutionary battle. Id.

ANS.—Because of its situation, Hague signifying *Hedge*. The article is retained, for reasons not known. We can not give origin of *Brandywine*.

EDITOR.

718. Are the historical works of Eusebius, Justin Martyr, Tertullian, Mosheim, and Ambras still in existence? Give sketches of these authors. J. W. DEBERY.

ANS.—Eusebius was born at Cæsarea, in Palestine, about A. D. 264, and is regarded as the father of ecclesiastical history. He was made bishop of Cæsarea in 315, took a leading part in the council of Nice in 327, and died about 340.

Ambrose was born about A. D. 340, probably at Treves. He was one of the most celebrated of early writers or fathers of the church. He was well educated and went to Milan. In 369, he was appointed Prefect of Milan, etc., and Bishop of Milan in 374. He died in 397.

Justinus was born near Shechem about the beginning of the second century. After studying the principles of the leading sects of heathen philosophies, he was converted to christianity, and it is supposed was beheaded about 165.

John L. Mosheim, writer of church history, was born at Lubeck, Germany, Oct. 9, 1694, and studied at Kiel. He died chancellor of the University of Göttingen, Sept. 9, 1755.

Tertullian, a Father of the church, and one of the first of them who used the Latin language in written composition. He was born in Carthage, and brought up a heathen—became well acquainted with Roman law, history, poetry and philosophy; he married a christian lady, and became presbyter, afterwards a Montanist. He was born about A. D. 150 and died about 220.

The most important works of Eusebius, Justin Martyr, etc., are still in existence. (Write *Bohn*, London, Eng., or *N. Tibbals & Sons*, New York.)

J. K. P. SAYLOR.

Eusebius was born about A. D. 264, and died 340. He was made bishop of Cæsarea in 315 and was a man of great learning, writing in Greek ten separate works mostly connected with Christianity. All his writings have reached our time in a more or less complete form. The work most frequently referred to by moderns is his *Ecclesiastical History* in ten books, which gives what he knew of Christianity from the birth of Christ to the year 324. His most valuable work, however, is the *Chronicon*, only preserved to us by a fragmentary Latin version by Jerome.

Tertullian was the most ancient of the Latin Fathers. What we know of him is derived from St. Jerome. He was born about 150 and died about 230. "His was an original and fiery spirit, seeking to grasp the divine in concrete forms" says *Bender*. An ascetic enthusiast and keen dialectician. He was a prolific writer. The *Apologetic*, a plea for Christianity, is the most important. His style is rough, abrupt, and abounding in hyperbole and far-fetched metaphors,

often reaching the ridiculous. He is often quoted by the opponents of eternal punishment as gloating over the supposed suffering of the damned.

Justin Martyr, one of the earliest Greek Fathers of the Church, born in 103 and died by martyrdom under Marcus Antoninus at Rome about A. D. 165. He wrote a large number of works, all lost but three. Two of these, Apologies for the Christian, addressed to the Roman Emperor Antoninus Pius and M. Aurelius and Verus. The third a Dialogue addressed to one Tryphon, a Jew, in which he defends Christianity from the Jew's attacks. Justin Martyr's writings are interesting to us only because they contain, perhaps, the earliest writings on Christianity outside of the Apostles which we possess, and he is generally quoted to show the apostolic origin of our gospels, not that he calls our Gospels by name, but his quotations contain similar statements to them.

Answered by C. A. Sebring,

HENRY GUNDER.

719. Name the first ten Popes, giving the date of their induction, and the three deposed by Henry III. with reasons for so doing. *Id.*

Ans.—St. Peter from 41 to 67; Linus 68; Cletus or Anaclethus, uncertain date; Clement I., uncertain date; Evaristus, about the year 100; Alexander I., who is said to have been the first to introduce the use of holy water in the service of the church, in 108; Sixtus I., a Roman, 119; Telesphorus, a Greek, 127; Hyginus, an Athenian, 138; Pius I., a native of Acquileia, 142. ED. RYNEARSON.

720. Note and describe the natural wonder on the island of Trinidad. U. S.

Ans.—The natural wonder is the "Asphaltum, or Pitch Lake," which is situated on a headland, jutting from the north-east corner of the island. It is elevated 80 feet above the ocean. Seen from the sea the headland resembles a dark, scoriaceous mass, and on a nearer view it is found to consist of bituminous scoria, vitrified sand and earth all cemented together. A strong sulphurous smell prevades the neighborhood for ten or twelve miles around, and is felt on approaching the shore. Deep crevices or funnels, sometimes six feet deep, are found in various parts of the asphaltum, filled with excellent water, often containing mullet, and other small fish. Alligators are said to have been seen in these extraordinary caverns. Several of these communicate with the sea, and experience the agitation of storms that ruffle the adjacent waters, often rising and falling during a storm six or eight feet, and scattering on the large masses of asphaltum. Pieces of what was once wood, are found completely changed into bitumen, and the trunk of a tree on being sawn, was entirely impregnated with pitch. When mixed with earth this substance acts as a fertilizer, and the finest fruits on the island come from the districts bordering on this singular lake. © JOHN KNISEEY.

The Pitch Lake of Trinidad is an extraordinary natural wonder. For several miles before reaching Cape La Brea, in the vicinity of the lake, a strong pitch smell is observed, and on landing the shore is found to be overlaid with the pitch which has found its way down from the lake. A walk of a mile inland over this black pitchy road brings the traveler to the lake, at a level of eighty feet above the sea. This lake is about a mile and a half in circumference. In the months of July, August and September the contents are in a simmering condition, here and there fountains of pitch and boiling water being thrown to a height of thirty feet. During the rest of the year the pitch near the borders is comparatively hard, the dangerous parts being indicated by the bubbling asphalt. At times one can walk on the lake, but must keep moving as the soft substance acts like quick sand. It is supposed that the lake has a subterranean communication with the sea, as submarine pitch volcanoes at some distance from Trinidad, throw up quantities of pitch and Pitch Lake products into the sea. Humboldt affirms that there is a correspondence between all of these and similar phenomena on the South American continent, with which the island of Trinidad was unquestionably once joined. H. A. WOOD.

QUERIES.

745. Locate and describe the Hoosic Tunnel. R.
 746. Give the emblems of European countries. D.
 747. How and whence came the bowlders in Ohio? D.
 748. Give a sketch of the animal of Pliocene times not yet extinct.
 749. Describe the serpent mound of Adams Co., Ohio. D.
 750. Who was the "Lost Child of America"? S.
 751. Who is the author of "The Battle Cry of Freedom"? S.
 752. Give a short history of Charles Mackay. F.
 753. What is meant by the "South-Sea Bubble"? F.
 754. In whose memory was the following written? F.
 Here lies she who never lied;
 Whose skill often has been tried;
 Her prophecies shall still survive,
 And ever keep her name alive.
755. When did France have a crazy king? W.
 756. What spring was changed by earthquake from cold to hot?
 757. Who was the "Golden-footed Dame"?
 758. What ruler occupied a different bed every night?
 759. What was the Tennis-court oath?
 760. When have fish been known to fall with a shower of rain?
 761. Describe the Sea Cucumbers. Tell where they are found.
 762. What king wrote an essay against the use of tobacco?
 763. We have seen somewhere the title "The Book-Fish. Explain.
 764. Describe the famous Dragon tree. The oldest tree now known.
 765. Give a short sketch of the "Infernal Triumvirate." K.
 766. Name all the cantons of Switzerland.
 767. Who was known as "The Protector of the Indians"?
 768. Give the author of the following:
 "The unfinished window in Alladin's tower unfinished must remain."
769. Is the story of Tell and Gessler a myth? Explain. B.
 770. Give all the allusions and applications of the term "Ring."
 771. What pope changed his name on ascending the papal chair?
 772. Give the legend of the Phoenix, and its applications.
 773. Give the natural history of the May-fly or June-bug. J.
 774. Explain the meaning of "blue stocking, and give its origin.
 775. Give a sketch of the present popular Ameer of Afghanistan.
 776. Can you see your own shadow?
 777. Of what benefit is lightning? What is a "cold stroke"?
 778. Where in this country are mud baths administered?
 779. Why are tides higher in the Red Sea than in Mediterranean?
 780. Did it ever "rain cats and dogs"?
 781. How is cotton refuse now utilized for building purposes?
 782. Why was Butler called "silver spoon"?
 783. When and where was the first S. S. started in America? H.

Answers should be received on or before Nov. 5, 1885.



EDITED BY

JOHN S. ROYER.

VOL. VI.

NOVEMBER, 1885.

No. 11.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

779. By WARREN LOY, *Pyrmont, Ohio*.—If 7 is $\frac{1}{5}$ of 20, what is $\frac{7}{8}$ of 39?

By PROF. H. A. WOOD, *204 East 51st., New York*.

This class of problems is easily solved by proportion. We shall always have, the true value of the first is to its assumed value as the true value of the second is to its required value; hence

$$\frac{1}{5} \text{ of } 20 : 7 :: \frac{7}{8} \text{ of } 39 : \text{value required.}$$

Therefore if 7 is $\frac{1}{5}$ of 20, $\frac{7}{8}$ of 39 = $59\frac{3}{4}$.

By L. A. REED, *75 Woodland Court, Cleveland, Ohio*.

If $\frac{1}{5}$ of 20 = 7, $\frac{5}{8}$ of 20 = 35; and 39 or $1\frac{1}{2}$ times 20 = $1\frac{1}{2} \times 35 = 68.5$. If 39 = 68.5, $\frac{1}{5}$ of 39 = 8.5625, and $\frac{7}{8}$ of 39 = 59.9375.

780. By A. M. SCRIPTURE, *Clinton, N. Y.*—Two fields, one square and the other circular, are enclosed by board fences. The boards are 11 ft. long, (bent to the form of the circular field,) and 4 boards to the length. There are as many acres in each field as there are boards in the fence. How many acres in each field?

By F. P. STAUFFER, *Stelvideo, Ohio*.

Joining the center of the circular field with the ends of a panel, we have a sector whose arc is 11 ft = $\frac{2}{3}$ of a rod, and area as many acres as rails, or 4 acres; $\therefore$ the diameter is $4 \times 160 \div (\frac{1}{2} \text{ of } \frac{2}{3}) \times 2 = 3840$ rods or 12 miles, and the area is $12^2 \times .7854 \times 640 = 72382.464$ acres.

Since there are four sides fenced of square field, each panels width across one side must contain 4×4 , or 16 acres, and $16 \times 160 \div \frac{2}{3} = 3840$ rods or 12 miles is the length of one side; $\therefore$ area is $12^2 \times 640 = 92160$ acres.

It will be observed that the former represents the largest circle that can be inscribed in the square.

781. *By* H. A. WOOD, *New York City*.—If a man had bought his horse for 20% less and sold it for the same as he now sells it for, he would have gained 30% more. What per cent does he gain?

By J. C. GREGG, *Brazil, Ind.*

The actual cost : supposed cost : : 5 : 4; hence actual selling rate : supposed selling rate : : 4 : 5, and difference of these rates is $\frac{1}{4}$ of actual selling rate; hence $30\% = \frac{1}{4}$ of selling rate which is 120%, and the gain is 20%.

By L. A. MATHIAS, *Enterprise, Ohio.*

Let $100\% =$ real cost; then $80\% =$ supposed cost. By second condition he gains 30% more than by the first; $\therefore 30\%$ of supposed cost is 24% of real cost. Therefore if 20% of real cost yield 24%, 100% will yield 120%. The gain is therefore 20%.

By H. A. WOOD, *Cleveland, Ohio.*

Since the horse is supposed to be sold for the same at each sale, $\frac{1}{80}$ of this sum is the amount received on each dollar cost by the second sale, and $\frac{1}{100}$ of the sale is amount received on \$1 at second sale; $\therefore \frac{1}{80} - \frac{1}{100} = \frac{1}{400} = \frac{3}{1000}$, the difference in the gain per cent. Therefore $\frac{1}{4}$ of selling price is 30% and $\frac{1}{4} = 120\%$, and the gain is 20%.

782. *By the same*.—If an article had cost me 10% less my rate of gain would have been 11% more. Required, my rate of gain or loss.

By D. S. POND, *Rochester, Ohio.*

Let $100\% =$ actual cost, and $90\% =$ supposed cost. Then by proportion, $10 : 11 :: 90 : (99\% = \text{sale})$ and loss is 1%.

By PROF. WOOD, *Cleveland, Ohio.*

The selling price divided by the cost gives the amount received for \$1 of cost. Since the selling price is the same in each case the difference between these amounts is the difference in the gain per cent; hence $\frac{1}{90} - \frac{1}{100} = \frac{1}{900}$ of selling price = $\frac{1}{100}$, or $\frac{1}{9}$ of selling price is 11%, and $\frac{8}{9} = 99\%$. Since the cost was 100% the loss is 1%.

By A. F. PARSONS, *Arroyo Grande, Cal.*

Let $x =$ rate of gain or loss; then we have $(1+x) \div .08 = 1+x+.11$, whence $x = -.01 = 1\%$ loss.

783. *By the same*.—A man stole £19 19s. 11d. 3far., for which he was sentenced to pay £19 19s. 11d. 3far. for every pound stolen; how much did he pay?

By GEO. C. RUSSELL, *San Francisco, Cal.*

By reduction we have £19 $\frac{23}{80}$, and the amount required is $19 \frac{23}{80} \times 19 \frac{23}{80} = £399$ 19s. 2d. $\frac{1}{80}$ far.

By WM. WILEY, *Detroit, Mich.*

The amount stolen was £ $(20 - \frac{1}{960})$, and $(20 - \frac{1}{960})^2 = 400 - \frac{1}{34} + \frac{1}{960}^2 = \text{£}399\ 19\text{s. } 2\text{d. } \frac{1}{960}\text{ far.}$

784. By G. L. SHANER, *Stewart's, Pa.*—The frustum of a pyramid has a slant height of 40 feet, a top 15 feet square and a base 50 feet square. By how much does the entire surface exceed that of the frustum of a cone, slant height 3 yards, radii of bases 6 feet and 6 inches, respectively. *Spiegel's Live Questions.*

By ALEX. CRAWFORD, *Como Depot, Miss.*

Area of two bases is $(15^2 + 50^2) = 2725$ sq. ft.; area of lateral surface is $4[\frac{1}{2}(15 + 50)] \times 40 = 5200$ sq. ft.; entire surface of frustum of pyramid 7925 sq. ft. The lateral surface of frustum of cone is $\frac{1}{2}[(12 + 1) \times 3.1416] \times 9 = 183.7836$; area of two bases is $(6^2 + .5^2) \times 3.1416 = 113.883$ sq. ft.; entire surface $297\frac{2}{3}$ sq. ft.; difference required is $7925 - 297\frac{2}{3} = 7625\frac{1}{3}$ sq. ft.

785. By Request.—A can buy a house for \$6,000 cash, or equal installments of \$1,200 a year for 6 years; which is better for A, money being worth 6%?

By J. C. GREGG, *Brazil, Ind.*

The initial value of \$1200, at 6%, is $\$1200 \div .06 = \$20,000$; then $\$20000 \times (1.06^6 - 1) = \8370.382 , and $\$8370.382 \div (1.06)^6 = \5900.789 , the present value of \$1200 per year for six years. Hence $\$6000 - \$5900.789 = \$99.211$ better on latter plan. For full explanation, see Ray's Higher Arithmetic.

By B. F. FINKEL, *North Lewisburg, Ohio.*

If simple interest is used the latter is better by \$6.38; for the sum of the present worths of \$1200 for 1, 2, 3, 4, 5 and 6 years, respectively, is $\$1132.075 + \$1071.428 + \$1016.949 + \$967.741 + \$923.076 + \$882.352 = \$5993.62$, which is less than cash payment as stated.

786. A fountain has 4 receiving pipes, A, B, C, and D; A, B, and C will fill it in 6 hours, B, C, and D in 8 hours, C, D, and A in 10 hours, and D, A, and B in 12 hours; it has also 4 discharging pipes, W, X, Y, and Z; W, X, and Y will empty it in 6 hours, X, Y, and Z in 5 hours, Y, Z, and W in 4 hours, and Z, W, and X in 3 hours; suppose the pipes all open, and the fountain full, in what time would it be emptied?

By J. W. WATSON, *Middle Creek, Ohio.*

We have for the part filled in one hour, $A + B + C = \frac{1}{6} \dots (1)$, $B + C + D = \frac{1}{8} \dots (2)$, $C + D + A = \frac{1}{10} \dots (3)$, and $D + A + B = \frac{1}{12} \dots (4)$. Subtracting (2) from (1) we have $A - D = \frac{1}{24} \dots (5)$; also, (1) - (3) gives $B - D = \frac{1}{5} \dots (6)$; and (1) - (4) gives $C - D = \frac{1}{2} \dots (7)$; adding (5), (6) and (7), we have $A + B + C - 3D = \frac{23}{60}$; but $A + B + C = \frac{1}{6}$,

and $3D + \frac{2}{120} = \frac{1}{6}$; whence $D = -\frac{1}{120}$, which indicates that D empties $\frac{1}{120}$ part in one hour instead of filling that part; $\therefore$ A fills $\frac{1}{80}$ in an hour, B $\frac{7}{120}$, and C $\frac{3}{40}$, and A, B, C, D fill $\frac{1}{20}$ in one hour.

Similarly, $W + X + Y = \frac{1}{6}$, $X + Y + Z = \frac{1}{6}$, $Y + Z + W = \frac{1}{4}$ and $Z + W + X = \frac{1}{3}$; subtracting (3) from (4) we have $X - Y = \frac{1}{12}$; (2) from (4) gives $W - Y = \frac{2}{15}$, and (1) from (4) gives $Z - Y = \frac{1}{6}$; adding these, gives $Z + W + X - 3Y = \frac{2}{5}$; but $Z + W + X = \frac{1}{3}$, and we have $3Y = -\frac{2}{15}$, or $Y = -\frac{1}{60}$, which shows that Y fills $\frac{1}{60}$ part in one hour instead of discharging. Then $X = \frac{4}{60}$, $W = \frac{7}{60}$, and $Z = \frac{9}{60}$, and W, X, Y, Z , discharge $\frac{3}{20}$ in one hour. Hence $1 \div (\frac{3}{20} - \frac{1}{60}) = 6\frac{2}{3}$ hours, the time required to empty the fountain when all the pipes are open. We conclude that D and Y should change places in the question.

NOTE.—This problem is in Robinson's Practical Arithmetic, p. 340, and was proposed by J. R. Baldwin, of Blue Grass, Iowa, to show that the statement is incorrect, and its fallacy is not observed by many teachers who use the book. He showed that D is a discharging, and Y a delivering pipe.

787. A merchant bought 400 yards of cloth at \$4 per yard, payable in 6 months, and immediately sold it at \$4.10, giving a credit of 3 months, at the expiration of which term he anticipated the payment of his own paper, getting a discount off of 10% per annum. What did he gain by the transaction?

By HON. JOSIAH H. DRUMMOND, *Portland, Me.*

He gave his note for \$1600, and sold for \$1640, payable in 3 mo.; assuming that he took a note also, at the end of 3 mo. 3 da., he received \$1640, and his note having precisely 3 months to run, the discount is \$40 at 10% per annum; so that after paying his note he has just \$80 left.

By A. F. PARSONS, *Arroyo Grande, Cal.*

He paid \$1600 and sold for \$1640. He then gained \$40 plus the discount on his \$1600 note for 3 months at 10%. In this state bank discount is always used by custom and no days of grace are allowed by law, hence his gain is $\$40 + 2\frac{1}{2}\%$ of \$1600 = \$80.

788. A merchant bought 400 yards of cloth at \$4 per yard, payable in 3 months, and after holding it for 15 days sold it at \$4.25 per yard, receiving therefore a note payable in 4 months. When the purchase money became due, he had this note discounted at the bank to meet it. What did he gain by the transaction?

By J. F. KULL, *Enterprise, Ohio.*

The cloth cost $\$4 \times 400 = \1600 , and sold for $\$4.25 \times 400 = \1700 , which discounted for 1 mo. 18 da. gives $\$1700 \times .992 = \1686.40 proceeds. His gain is \$86.40.

789. Taking the conditions of the last example, what would he have gained if he had borrowed at 6% interest until the maturity of the note he had received, sufficient to pay for the cloth; and why should there be any difference in the results?

By A. M. SCRIPTURE, *Clinton, N. Y.*

If he had borrowed \$1600 for 1 mo. 18 da. at 6%, his cloth would have cost \$1612.80, and gain would have been $\$1700 - \$1612.80 = \$87.20$, neither obligation bearing interest. Here he would have allowed interest on \$1600 for a time. But discounting the \$1700 note, he allowed interest on \$1700 at the same rate and for same time, and the difference is $\$87.20 - \$86.40 = \$.80$.

790. What length must be cut from the narrow end of a board to contain a square foot, the length of the board being 6 feet, its width at one end 12 in. and at the other 8 inches?

By G. W. LEAHY, *Marshallville, Ohio.*

If the board be increased till it comes to a point, it will be 18 feet long and contain $(18 \times 1) \div 2 = 9$ sq. ft. The part cut off will then be $[(\frac{2}{3} \times 12) \div 2] + 1 = 5$ sq. ft., and by similar triangles $9 : 5 :: 18^2 : (13.416)^2$, and the cut must be $13.415 - 12 = 1.416$ ft. from narrow end.

791. A, B, C, D, purchase a farm for \$9,000. The purchase money is \$1500 more than A, B, and C, are worth, \$200 more than B, C, and D, are worth, \$700 more than C, D, and A are worth and \$1200 more than A, B, and D, are worth. How much money has each?

By L. A. MATHIAS, *Enterprise, Ohio.*

D's excess over A's is $\$1500 - \$200 = \$1300$; B's excess over A's is $\$700 - \200 , or \$500; C's excess over B's is $\$1200 - \$700 = \$500$; C's excess over A's is $\$500 + \$500 = \$1000$. Then $\$9000 - \$1500 = \$7500$ is what A, B, and C are worth and $[\$7500 - \1500 (B's and C's excess over A's)] $\div 3 = \$2000$, A's amount; hence B's = \$2500, C's = \$3000, and D's = \$3300.

By J. W. JONES, *South Bloomfield, Ohio.*

A, B, and C are worth \$7500; B, C and D, \$8800; A, C and D, \$8300; A, B and D, \$7800; adding gives \$32400, which is 3 times what all are worth. Hence A is worth $\$10800 - \$7800 = \$2000$; B, $\$10800 - \$8300 = \$2500$; C, $\$10800 - \$7800 = \$3000$; and D, $\$10800 - \$7500 = \$3300$.

792. A metallic cylinder, 20 inches long, and 2 inches in diameter, is closed at each end by a hemisphere; if the whole solid is converted, without loss, into a sphere, what is its diameter?

By R. A. LEISY, Marshallville, Ohio.

The solidity of cylinder and two hemispherical ends is $(2^2 \times .7854 \times 20) + (2^3 \times .5236) = 67.0208$ cu. in.; hence the required diameter is $\sqrt[3]{(67.0208 \div .5236)} = 5.0396842$ inches.

By C. W. HEIRONIMUS, New Madison, Ohio.

Contents of cylinder without closed ends is $1^2 \times \pi \times 20 = 20\pi$; the ends make a sphere 2 inches in diameter containing $2^3 \times \frac{1}{6}\pi = 1\frac{1}{3}\pi$; $\therefore 21\frac{1}{3}\pi$ is the solidity of the required sphere, and its diameter is found by dividing the solidity by $\frac{1}{6}\pi$ and extracting cube root; hence $21\frac{1}{3}\pi \div \frac{1}{6}\pi = 128$; $\sqrt[3]{128} = 5.0396842$ inches.

793. Two trains, one 210 feet and the other 230 feet long move on parallel tracks. When going in the same direction they pass each other in 15 seconds, and when going in opposite directions they pass in $3\frac{3}{4}$ seconds. How many miles an hour were they moving?

By A. M. SCRIPTURE, Clinton, N. Y.

Let A denote the faster train and B the other. Then A must move $230 + 210 = 440$ feet to pass B when running the same way, or $440 \div 15 = 29\frac{1}{3}$ feet is A 's excess of rate per second. In opposite directions they together accomplish $440 \div 3\frac{3}{4} = 117\frac{1}{3}$ feet per second, but of this A runs $29\frac{1}{3}$ feet further than B . Now half the sum *plus* half the difference is the greater, and half the sum *minus* half the difference is the less; hence $\frac{2}{6} \cdot 117\frac{1}{3} + \frac{2}{6} \cdot 29\frac{1}{3} = 73\frac{1}{3}$ is A 's rate per second and $\frac{2}{6} \cdot 117\frac{1}{3} - \frac{2}{6} \cdot 29\frac{1}{3} = 44$ is B 's rate. Hence trains run 50 and 30 miles per hour, no matter which has the greater speed.

794. At what time between 10 and 11 o'clock do the hour and minute hands make equal angles with a line from XII. to VI.?

By D. W. K. MARTIN, Webster, Ohio.

At 10 o'clock the hour hand is at X. and the minute hand at XII.; and for the hour and minute hands to make equal angles with the line, the minute hand must be at II. But in that time the hour hand will have moved a certain distance from X. and the minute hand will have traveled 12 times this distance from XII. and be the same distance from II.; hence 12 times the distance plus 1 times the distance = 13 times the distance moved over by the hour hand, or 10 minute spaces, and $(10 \div 13) \times 12 = 9\frac{3}{13}$ minutes after 10 o'clock.

Again, the minute hand should be at IV. to make equal angles; $\therefore$ 12 times the distance traveled over by the hour hand *minus* once the distance, which must be the distance the minute hand is after IV, e-

equals 11 times the distance or 20 minutes; and $(20 \div 11) \times 12 = 21\frac{9}{11}$ minutes after 10 o'clock.

Again, the minute hand should be at VIII. to make the angles equal; hence $[40 \div (12 + 1)] \times 12 = 36\frac{1}{3}$ minutes after 10 o'clock.

Again, they will make equal angles when they are together, then $[50 \div (12 - 1)] \times 12 = 54\frac{6}{11}$ minutes after 10 o'clock.

795. A square prism of solid glass 9 inches long was dropped into a cubical vessel containing 6 gal. 3 qt. $3\frac{3}{4}$ gi. of water, and the water came to the brim. Find the thickness of the glass, if the capacity of the vessel was one cubic foot.

By WILLIAM TAIT, Greenwich, Ohio.

By reduction we have $6\frac{3}{4}$ gal. which makes $6\frac{3}{4} \times 231 = 1584$ cu. in. The volume of glass prism is $1728 - 1584 = 144$ cu. in.; the area of one end is $144 \div 9 = 16$ sq. in., and the thickness $\sqrt{16} = 4$ in.

796. A conical cork whose slant height is 5 inches and diameter of base 6 inches floats on water with vertex downward. If its specific gravity is .125, how many inches of its axis will be under water?

By GEO. W. LEAHY, Marshallville, Ohio.

Altitude of cone is $\sqrt{(5^2 - 3^2)} = 4$; the weight of cone is $\frac{1}{8}$ of an equal bulk of water, and $\frac{1}{8}$ of its volume will be under water. Solidity of cone is $(3^2 \times \pi \times 4) \div 3 = 12\pi$, and $\frac{1}{8}$ of $12\pi = 1\frac{1}{2}\pi$ is volume of cone under water; hence by similar solids, $12\pi : 1\frac{1}{2}\pi :: 4^3 : (\text{axis under water})^3$, and $1\frac{1}{2}\pi \times 4^3 = 96\pi$; $96\pi \div 12\pi = 8$; $\sqrt[3]{8} = 2$ in.

By J. H. W. SCHMIDT, Ansonia, Ohio.

Representing the volume of cone and its axis each by unity, we have $\sqrt[3]{1} : \sqrt[3]{\frac{1}{8}} :: 1 : (\frac{1}{2})$; $\therefore$ half of axis is under water, or 2 in.

797. In turning a cart within a circle it was observed that the outer wheel made three turns while the inner made but two; the wheels were each 3 feet high, and the tracks $4\frac{1}{2}$ feet apart. Required, the length of the outer track.

By WM. WILEY, Detroit, Mich.

Evidently, the outer track is $1\frac{1}{2}$ times the inner, and the radii are in the same proportion; hence $4\frac{1}{2}$ feet must be $1\frac{1}{2} - 1 = \frac{1}{2}$ time inner radius, or the diameter of inner circle is $2 \times (4\frac{1}{2} \div \frac{1}{2}) = 18$ feet, and the diameter of the outer $(18 \times 1\frac{1}{2}) = 27$; the length of outer track is $3.14159 \times 27 = 84.82293$ ft.

798. A merchant in Cincinnati wishes to pay a debt of \$1400 in San Francisco. The time discount being 5% and exchange $\frac{1}{8}\%$ premium, what must he pay for a 60-day draft?

By H. A. WOOD, Cleveland, Ohio.

The bank discount of \$1 for 63 days, at 5%, is \$.0085, which subtracted from \$1, equals \$.99125, cost of \$1, if the exchange was at par. Adding the premium of $\frac{1}{8}\%$ = \$.00125, the actual cost of \$1 of the draft is \$.9925; hence $\$1400 \times .99\frac{1}{4} = \1389.50 , cost of draft.

799. I wish to line the carpet of a floor whose area is $34\frac{5}{8}$ sq. yd., and whose length is to its breadth as 38 to 33, with muslin $\frac{2}{3}$ of a yard wide; how many yards of muslin must I buy, if it will shrink 4% in length and 5% in width?

By A. L. FOOTE, Hempstead, N. Y.

The width after shrinking is 95% of $\frac{2}{3} = \frac{1}{3}\frac{1}{4}$ yd. A room 38 by 32 would contain 1254 sq. yd., but to contain $34\frac{5}{8}$ sq. yd the room must be $\sqrt{(34\frac{5}{8} \div 1254)} = \frac{1}{8}$ of the assumed dimensions, or $6\frac{1}{3}$ yd. long and $5\frac{1}{2}$ yd. wide. Now $6\frac{1}{3} \div \frac{1}{3}\frac{1}{4} = 8$ breadths of carpet laid across the room. But since the carpet shrinks 4% in length, it will require $(5\frac{1}{2} \div .96) \times 8 = 45\frac{5}{8}$ yards.

By J. C. GREGG, Brazil, Ind.

A yard of muslin when shrunk will contain $\frac{9}{10}\frac{6}{10} \times \frac{9}{10}\frac{5}{10} \times \frac{5}{6} = \frac{1}{2}\frac{7}{5}$ sq. yd.; hence it will take $34\frac{5}{8} \div \frac{1}{2}\frac{7}{5} = 45\frac{5}{8}$ yards.

800. A Boston merchant remitted to Cleveland a draft for \$1250, at 90 days, at 6%, paying for it 1221.25; what was the rate of exchange?

GEO. L. SHANER, Stewart's Station, Pa.

The proceeds on \$1 for 93 days at 6% is \$.9845, and the draft is worth $\$1250 \times .9845 = \1230.625 ; the discount is $\$1230.625 - \$1221.25 = \$9.375$, and the required rate, $9.375 \times 100 \div 1250 = \frac{3}{4}\%$.

749. How much will a solid cast-iron pillar 10 feet high and 4 inches in diameter, support at its upper end when fixed at the other?

By A. M. SCRIPTURE, Clinton, N. Y.

From the general formula in Scribner's Engineer's Table Book, $9562d^4 \div (4d^2 + .18l^2)$, we have in this case, $(9562 \times 4^4) \div (4 \times 4^2 + .18 \times 10^2) = 29,852$ lbs. A safe load would be 26,600 pounds.

By L. G. WEAVER, Dayton, Ohio.

He pays $1221.25 \div 1250 = $.977$ on each dollar of the face value of draft. The proceeds on \$1, for 93 days, at 6%, are \$.9845; hence the exchange is $$.9845 - $.977 = $.0075 = \frac{3}{4}\%$ discount.

NOTE.—PROF. H. A. WOOD sent an elaborate solution of Prob. 775, but it came too late for credit in last issue.

CREDITS.—Messrs. Wood, Foote, Parsons, Gregg, Wiley, Reed, Tait, Russell, Schmidt, Mathias, Martin, Scripture, Drummond, Stauffer, Leisy, Heironimus, Leahy, Finkel, Kull, Crawford, Rice and Watson, solved all the Sept. problems, and brief sketches of their lives will be published next month. Partially solved by D. S. Pond, Rochester, Ohio; J. W. Jones, South Bloomfield, Ohio; George L. Shaner, Stewart's Station, Pa.; John Kniesly and Ed. Rynearson, Gettysburg, Ohio.

Problems for Solution.

813. *By Request.*—A beat B by 80 ft. in a foot race, but if A had walked $\frac{5}{8}$ of his rate and B $\frac{9}{10}$ of his, A would have beat B by 26 ft. How far did they walk?

814. *By Request.*—I bought goods and paid a certain import duty on them. I marked them so as to gain 20% of the total cost, but being obliged to throw off 10% of this marked price, my gain was only 10% of the first cost of goods. What was the rate of duty?

815. *By A. M. SCRIPTURE, Clinton, N. Y.*—A child building a cubical monument of cubical blocks of equal size found that he lacked enough for just one course. The side of the monument was x blocks. He reconstructed, with $x-1$ blocks on a side and had blocks left, out of which he built a second monument with $x-2$ blocks on a side, and a third with $x-3$ blocks, and a fourth with $x-4$ blocks on a side, which exhausted his supply. How many blocks had he?

816. *By J. R. SPIEGEL, Greensburg, Pa.*—A barn is 25 ft. square, to a corner of which a horse is tied with a rope 100 feet long. How much can he graze over?

817. *By PROF. WM. HOOVER, Athens, Ohio.*—The north declination of a star on the prime vertical, at an altitude of 40° , is 30° ; find the latitude of the observer.

818. *By D. S. POND, Rochester, Ohio.*—A wished to make a wooden cistern one foot longer than wide, and two feet wider than deep, which required 325.5 feet (surface measure) of 3-inch plank. Find outside dimensions of cistern.

819. *By Request.*—The hour-hand of a clock moves 5% too fast and the minute-hand 10% too slow. In 15 minutes (true time) they will be together; how many minute-spaces are they apart now?

820. *By Request.*—There are 17 books on a shelf, of which 5 are of one set, 3 of another, 2 of another, and the rest are odd. Find the number of different arrangements that can be made with them, each set to be kept intact, though the order of books in it may be changed.

821. *By Request.*—If 4 pumps, each having a length of stroke 3 feet and piston radius 3 inches, empty a cubical cistern whose side is 6 feet in one hour, what must be the radius of the piston of each of 6 pumps whose stroke is 4 ft., that they may empty a cistern whose sides are half those of the former in $\frac{2}{3}$ of an hour, there being a defect in the latter pumps taking 10% of their efficiency? By proportion.

822. *By Request.*—A bridge when measured on the floor is 80 feet in length, and by looking across from one end to the other, it is found that the middle is two feet higher than the ends. If the floor of the bridge be the arc of a circle, what is the diameter of that circle?

823. *By Request.*—I bought $2\frac{1}{2}\%$ stock at 80% and $4\frac{1}{2}\%$ stock at 85%. The income on the former was $44\frac{2}{3}\%$ more than by the latter, but I invested \$22140 less in latter than in former; what per cent do I realize on my investment?

824. *By Request.*—I invest $\frac{2}{3}$ as much in 8% canal stock at 104%, as in 6% gas stock at 117%; if my income from both is \$1200, how much did I pay for each and what was my income from each?

Solutions should be received on or before Dec. 5, 1885.

ENGLISH GRAMMAR.

Answers to Queries.

Explain the difficult grammatical constructions in the following stanzas from Gray's *Elegy*. S.

Full many a gem of purest ray serene,
The dark, unfathomed caves of ocean bear;
Full many a flower is born to blush unseen,
And waste its sweetness on the desert air.

ANS.—*Full* is an adverb, modifying *many*; *caves* is the subject, and *gem* the object of *bear*; *serene* is an adjective, modifying *ray*; *to blush* and *to waste* have the construction of adverbs, modifying *is born*; *unseen* is in the predicate with *to blush*, and refers to subject *flower*; *on* shows relation of *air* to *waste*.

Some village Hampden, that, with dauntless breast,
The little tyrant of his fields withstood,
Some mute, inglorious Milton here may rest,
Some Cromwell, guiltless of his country's blood.

ANS.—*Hampden*, *Milton* and *Cromwell* are the subjects of *may rest*; *Hampden* is modified by the relative clause in which *that* is the subject, and *tyrant* the object of *withstood* (predicate).

The applause of listening senates to command,
The threats of pain and ruin to despise,
To scatter plenty o'er a smiling land,
And read their history in a nation's eyes,

ANS.—*To command*, *to despise*, *to scatter* and *[to] read* have the construction of adjectives, limiting *them* understood which is the object of *forbade* and *lot* the subject, in first line of next stanza. *Applause*, *threats*, *plenty* and *history* are the objects of said infinitives.

Their lot forbade: nor, circumscribed alone
Their glowing virtues, but their crimes confined;
Forbade to wade through slaughter to a throne,
And shut the gates of mercy on mankind,

ANS.—We have this idea—Nor were their glowing virtues alone circumscribed, but their crimes were confied by their lot. *Virtues* and *crimes* are the subjects and *[were]* *circumscribed* and *[were]* *confined* the predicates. *Alone* is an adjective modifying *virtues*. In the next sentence *lot* understood is the subject and *forbade* is the predicate, modified by *them* understood. *Them* is modified by the infinitives, *to wade*, *to shut*, and (in next stanza which is not necessary to print) *to hide*, *to quench* and *to heap*. The prepositional phrases *to a throne* and *on mankind* modify the infinitives *to wade* and *to shut*.

Far from the madding crowd's ignoble strife,
Their sober wishes never learned to stray;
Along the cool, sequestered vale of life,
They kept the noiseless tenor of their way.

ANS.—The first line is independent, *they being far from*, etc. *They* is modified by *being-far*, *being* as a participle and *far* as a predicate adjective; *far* is modified by *from strife*. *To learn* has the construction of an adverb, limiting the predicate *learned* (here intransitive). The other is easy.

Examination Questions.

ARITHMETIC.

1. (a) $\frac{1}{8}$ of a tenth $-\frac{5}{9}$ of a hundredth = what? (b) $.00001 \div 1000$ = what? (c) $.041\frac{2}{3} \div 15\frac{2}{3}$ = what?

Ans.—(a) $.0\frac{1}{8} = .001\frac{2}{3}$; and $.001\frac{2}{3} - .00\frac{5}{9} = 0$. (b) $.00001 \div 1000 = .00000001$. (c) $.041\frac{2}{3} \div 15\frac{2}{3} = .2\frac{2}{3}$.

2. $\frac{2}{3}$ of a mile $-\frac{7}{11}$ of a furlong = what?

Ans.—We have $\frac{2}{3}$ mi. = 1 fur. 31 rd. 1 ft. 10 in., and $\frac{7}{11}$ fur. = 25 rd. 7 ft. 6 in.; subtracting gives 1 fur. 5 rd. 10 ft. 10 in.

3. A man after doing $\frac{2}{3}$ of a piece of work in 30 days engages an assistant and both together complete it in 6 days. In what time could the assistant do it alone?

Ans.—The man can do the whole work in $30 \div \frac{2}{3} = 50$ days; the man and assistant, in $6 \div \frac{2}{3} = 15$ days; hence $1 \div (\frac{1}{50} - \frac{1}{15}) = 21\frac{2}{3}$ days is the time required.

4. Bought a house for \$4500; it rented for \$500 a year. Paid \$25 for insurance, taxes $1\frac{8}{10}\%$, and \$134 for repairs. What net per cent did it pay on the investment?

Ans.—Deducting expenses $\$25 + (\$4500 \times .018) + \$134$, or \$240, leaves net balance of \$260 on rent; $260 \times 100 \div 4500 = 5\frac{2}{3}\%$.

5. How many gallons of water will fill a cistern whose top and bottom diameters are respectively 26 and 10 inches and depth 36 inches?

Ans.—The best rule to find the capacity of this cistern is—*Multiply the diameters of the top and bottom together; to the product add $\frac{1}{3}$ of the square of the difference of diameters, and multiply by the depth and by .0034.* Hence $[26 \times 10 + 85\frac{1}{3}] \times 36 \times .0034 = 42.2688$ gals.

6. The interest on A's, B's, and C's fortune for 5 years at 8%, is \$1040. What is the fortune of each if they are to each other as $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$?

Ans.—The principal, or sum of their fortunes, is $\$1040 \div .40 = \2600 ; this divided in proportion of 6, 4 and 3, gives A \$1200, B \$800, C \$600.

7. Find the cost of plastering a room 17 feet long, 13 feet wide, and 9 feet high, at 7 cents a square foot.

Ans.—Area of ceiling is $17 \times 13 = 221$ sq. ft., and of sides $(34 + 26) \times 9 = 540$ sq. ft.; the cost is $(221 + 540) \times .07 = \53.27 .

8. If 20 men in $16\frac{1}{2}$ days of 8 hours each, dig a ditch 88 rods long, 8 feet deep, and 3 feet wide; how many men will be required to dig a ditch 360 rods long, 12 feet deep, and 8 feet wide, in 18 days, by working 12 hours each day?

Ans.—By proportion, $\frac{20}{1} \times \frac{8}{12} \times \frac{12}{8} \times \frac{360}{88} \times \frac{8}{12} \times \frac{16.5}{18} = 200$ men.

9. Reduce 5553 to drams av.

Ans.—We have $555 \times 3 \times 20 = 33300$ gr.; $33300 \div 27\frac{1}{2} = 1217\frac{2}{3}$ dr.

10. Find the difference between the true and bank discount of \$359.50 for 90 days, without grace, at 12%?

Ans.—The true discount on \$1 is the present worth of its simple interest; the interest on \$1 for the given time and rate is 3 cents; hence $\$1\frac{3}{100} - \$1\frac{3}{100} = \$1\frac{3}{100}$ is the difference between the two discounts on \$1; $\$359.50 \times \frac{3}{100} = \21.256 .

GRAMMAR.

1. Write a complex sentence containing an adjective clause and an adverbial phrase, and mark each.

Ans.—We marched *one by one* to the cottage *where the little child lay sick*.

2. What is the difference between inflection in grammar and inflection in reading?

Ans.—Inflection in grammar alludes to the variation in form of the adjective (comparison), noun and pronoun (declension), and verb (conjugation); hence these parts of speech are said to be inflected. Inflection in reading refers to the variations of pitch of the voice on different words and syllables of a sentence.

3. How distinguish the elements of the first, second, and third classes?

Ans.—By their bases.

4. Conjugate the verb *saw*, active and passive, indicative mode.

Ans.—See your grammar for the form of conjugation in both voices.

5. Define comparison, and to what parts of speech does it belong?

Ans.—It belongs to adjectives and a few adverbs.

6. Write possessive, singular and plural of lady, I, brother-in-law.

Ans.—Lady's, ladies'; my, our; brother-in-law's, brothers-in-law's.

7. Give examples of *that* used as four parts of speech.

Ans.—I could not believe that (conj.) that (adj.) that (noun) that (rel. pro.)
I parsed was a noun.

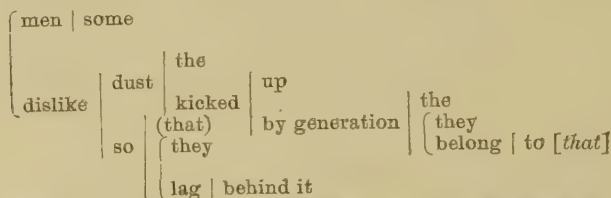
8. State difference fully between a personal and a relative pronoun.

Ans.—The chief difference exists in this: That personal pronouns show by their form of what person they are, and are capable of leading or introducing a sentence, without having reference in the construction to any thing previous, while relative pronouns do not have these characteristics.

9. Name four poetic feet.

Ans.—Iambic, trochaic, anapestic, and amphibrach.

10. Diagram and parse italicized words: Some men so *dislike* the dust *kicked* up by the generation they belong to, *that*, being unable to pass, they lag behind *it*.



Dislike is a regular transitive verb; it is in the indicative mode, present tense, and agrees with its subject *men* in the third person and plural number.

Kicked is a perfect participle, derived from the verb *to kick*; it has the construction of an adjective, limiting *dust*.

To is a preposition, showing the relation between *belong* and *that* understood.

That is a subordinate conjunction; it connects the adverbial clause and so.

It is a personal pronoun; its antecedent is *dust* with which it agrees in the third person, singular number and neuter gender; it is in the objective case, object of the preposition *behind*.

GEOGRAPHY.

1. What are the uses of rivers?

Ans.—To drain the country of surplus waters, and to carry off impurities; to afford natural highways for transportation lines, and water power for manufacturing purposes; to enable fish to reach the interior and to distribute themselves for man's economy.

2. Suppose the inclination of the earth's axis to be 30° , how would we determine the width of the zones?

Ans.—The frigid zones would be 30° wide, and the torrid 30° on each side of the equator; hence the temperate zones would be $90 - (30^\circ + 30^\circ) = 30^\circ$ wide.

3. What is the difference between a physical and a mathematical zone?

Ans.—The physical zones have direct reference to equal temperature, and are marked on maps by isothermal lines; on the contrary, the mathematical or astronomical zones have no significance so far as climate is concerned, as they indicate neither temperature nor the distribution of moisture, and are bounded by the tropics and polar circles.

4. On what waters would you sail in going from Chicago to Cin.?

Ans.—The Great Lakes, St. Lawrence, the Atlantic, Gulf of Mexico, Mississippi and Ohio rivers.

5. In what zone have the people made the greatest progress in arts, sciences, religion, etc.? Why?

Ans.—In the north temperate zone, because the physical conditions of that portion of the earth's surface, such as climate, natural products, and surface structure, are most favorable to physical and mental activity.

6. Locate five of the largest cities in Ohio.

Ans.—Cincinnati, Cleveland, Columbus, Toledo and Dayton.

7. Bound Ohio. Name the products, exports, imports, manufactured articles, and the western tier of counties.

Ans.—It is bounded by Mich., L. Erie, Pa., Ohio River and Ind. Its chief products are the cereals, wool, pork, fruit, tobacco, dairy products, live stock, coal and iron. Manufactured articles are flour, farming utensils, machinery, boots and shoes, furniture, woollen goods, etc.

8. Bound the State in the U. S. that is bounded by eight states.

Ans.—The state is Tennessee. See map.

9. Describe France. Give boundaries. Name and locate three rivers, the products, and principal exports.

Ans.—It is a republic and has one of the healthiest climates in Europe, being rich in mineral springs (1000 in use). It is bounded by the Eng. Channel, Belgium, Gr. Duchy of Luxembourg, the Rhenish provinces of Prussia, Alsace, Lorraine, several Swiss Cantons, Italy, Mediterranean, Spain, and the Atlantic. It has four great rivers—Seine, Loire, Garonne and Rhone. Products are chiefly the cereals, vine, chestnuts, olives, culinary fruits and vegetables, hops, sugar beet, tobacco, madder, chicory, coal and iron, costly fabrics and fancy articles. The chief source of industrial wealth is the production of silk. Principal exports are silk, woollen and cotton stuffs, fancy articles, wines, jewelry, and corn. Imports—Wool, cotton, hides, coal, etc.

10. Briefly describe the mountain systems of North America.

Ans.—The Appalachian in the east, the highest point of which is Black Dome (6,707 ft.) in N. C. The Cordilleras in the west; highest peak is Popocatepetl (17,783 ft.) in Mexico.

HISTORY.

1. Define history and name some of the leading objects to be attained in its study.

Ans.—History is a methodical record of the important events which concern a nation in connection with their causes and effects. The leading object should be to study the causes and effects of events, and become acquainted with the character, customs and spirit of a nation.

2. With what important event does the true history of our country commence?

Ans.—It properly commences with the Declaration of Independence. All pertaining to the discoveries, explorations, or settlements of this broad domain, belongs to the history of the countries that made them. It is necessary to trace their influences in the formation of the colonies, but the period that gave birth to this nation and the wonderful growth of the country since then should receive most careful study.

3. Of what nationalities are the people of our country principally composed?

Ans.—English, German and French.

4. When was Ohio formed? When admitted into the union? Who was the first governor? How many counties in the state?

Ans.—April 30, 1802, Congress passed an Act to enable the people of the eastern division of the "Territory Northwest of the River Ohio", to form a constitution and a state government, and for the admission of such state into the Union. On the second Tuesday of October, the members of the constitutional convention were elected. Said members met at Chillicothe, Nov. 1, and framed a constitution, which was duly signed and adopted Nov. 29. They declared it operative at once, and the territorial officers were required by terms of the constitution, to proceed to discharge the duties of their respective offices until their successors were duly elected and installed. The constitution further designated the second Tuesday of Jan. 1803, as the time to elect a Governor, members of both branches of the State Legislature, sheriff's and coroners, whose term of office was to begin March 1, 1803. By provision of the constitution, the Legislature met March 1, 1803, and on the 2d, Gov. Edward Tiffin was inaugurated, and Charles Willing Byrd, the Acting Territorial Governor, retired. Thus, it came to pass the great state of Ohio was originally formed and equipped. But as to its admission there is a disparity of opinion. Some say April 30, 1802; many say Nov. 29; others, Feb. 19, 1803, the date of an "Act passed by Congress to provide for the due execution of the laws of the U. S. in the State of Ohio"; and still some prefer to date the admission March 3. Since the Constitution was framed according to direction of Congress and the state government instituted Nov. 29, 1802, and because of the non-submission of the measure to the vote of the people, and the implied approval of the constitution by Congress and the President in the Act of Feb. 19, without formal action or proclamation, we have followed the old reliable authorities, and prefer to recognize Nov. 29, 1802, as Ohio's birthday and its virtual admission into the union. There are 88 counties in the state.

5. Name the thirteen original states?

Ans.—N. H., Mass., R. I., Conn., N. Y., N. J., Pa., Del., Md., Va., N. C., S. C., and Ga.

6. Name the most noted inventions of the 15th century. Some of the 19th century.

Ans.—No inventions were made in America during the 15th century. But elsewhere—In 1643, Torricelli invented the barometer; in 1657, the fire engine

by Hautsch; in 1625, gas by Van Helmont; in 1672, the railroad by Beaumont; in 1608, the telescope by Lippersheim; and in 1609, the thermometer by Drebbel. The chief American inventions are as follows:

BENJ. FRANKLIN (1706-90), invented the lightning rod in 1752.

ELI WHITNEY (1765-1825), cotton gin in 1783.

ROBT. FULTON (1765-1825), steamboat in 1793; submarine torpedoes in 1797.

JETHRO WOOD (1774-1834), the cast-iron plow in 1814.

THOMAS BLANCHARD (1788-1864), the tack machine in 1806; steam carriage in 1825; stern-wheel boat for shallow water, and the turning lathe for irregular forms of wood in 1843.

ROSS WINANS (1798—), in 1825 commenced to invent many railroad improvements.

CYRUS H. MCCORMICK (1809—); harvesting machine in 1850.

CHARLES GOODYEAR (1800—), the process of vulcanizing india rubber in 1839.

SAMUEL F. B. MORSE (1791-1872), the magnetic telegraph from 1837 to 1844.

ELIAS HOWE (1819-1867), the modern sewing machine in 1846.

JAMES B. EADS (1820—), author of steel bridge at St. Louis, 1867, jetties below New Orleans, 1876, and builder of Union arms in 1861.

JAMES LYALL (1836—), simple mixture for enameling cloth for Knapsacks in 1863; and the positive-motion loom in 1868.

7. How many voyages did Columbus make to America? When was each made and what places were visited?

ANS.—Four. The first in 1492 to the Bahamas, Cuba and Hayti. Second, in 1493 to Jamaica and Porti Rica. Third in 1498 to the coast of S. America. Fourth in 1502 to Honduras, Costi Rica, etc.

8. From what states have presidents been elected?

ANS.—VA., Mass., Tenn., N. Y., Ohio, La., N. H., Pa., and Ill.

9. What was the Dred-Scott Decision? The Missouri Compromise? The Kansas-Nebraska Bill?

ANS.—In the year 1818 Missouri made application to be admitted into the Union, but Congress refused by the vote of the free states against the slave states, on an amendment forbidding slavery within it. In 1820 the application was renewed and connected with that of Maine, so that both would stand or fall together. The House favored the admission of both without slavery; but the Senate voted to admit Me. and Mo. with slavery. Henry Clay then came in with his "Compromise", in which it was determined to vote for each separately, and that slavery should be permitted in Mo., but forever prohibited north of 36° 30'. Both states were then admitted. Kansas-Nebraska Bill provided for two new territories (1853) declaring that the old "Compromise" of 1820 was rendered void by that of 1850, and that the inhabitants of the territories must decide the slavery question. For Dred-Scott Decion, see p. 61, April Visitor.

10. What was the Gadsden purchase?

ANS.—An area of 45,535 square miles, embracing part of Arizona and New Mexico, was purchased of Mexico, Dec. 30, 1853, for \$10,000,000, by Jas. Gadsden, who was sent to Mexico to negotiate a treaty which defined the boundary between Mexico and the U. S. Mr. Gadsden was a politician, born at Charleston, S. C., 1788, and died 1858.

SPELLING.

Soliloquy, symmetry, porcelain, accelerate, orifice, liquefy, glycerine, biscuit, gorgeous, ductile, wizard, mutilate, parallelogram, chloroform, trisyllable, tonsil, fracas, mantel, superstitious, inflection.

NOTE.—Orthography is made up of spelling this time.

 MISCELLANEOUS DEPARTMENT.

This department is full of good things, our talented contributors having enriched these pages with valuable information, that words of highest praise have come from many appreciative readers. Let all interested contribute their *best* thoughts and queries. The queries in this number are very good. The contributor's names are distinguished by initials which are placed after his first query. Thus "J. H. W." (J. H. W. Schmidt) proposed 799-805 (seven queries).

 Answers to Queries.

Comments on Query 646. Give an explanation of the magnetic meridian, with hints for surveying old lines.

The obliteration of old land-marks, is a frequent source of misunderstanding between parties, and it is a well known fact to surveyors that from the variable direction of the magnetic needle no line can be determined by having a single point in it, unless we have some other established line connected with the survey, to determine the change in the direction of the magnetic needle. I would suggest, therefore, in order to avoid these difficulties, that each township have at some convenient place therein, a true meridian laid out by observations of the Pole star when above or below the meridian, and that every surveyor before entering upon any survey be required to test the variation of his compass by this line and make note of the fact on his survey. By this precaution a subsequent surveyor may trace out a line by having a single point in it.

A. L. FOOTE.

658. What President did not belong to a secret society? Does Cleveland belong to any secret society?

Ans.—John Quincy Adams never belonged to any secret society. Who can inform us to which society each president belong?

J. S. HOYMAN.

698. "Decoration Day" always comes on May 30. Can you tell why and when this date was established?

Ans.—I wish to correct a misstatement in answer to this, p. 174. It is stated there that Decoration Day was set on the 30th of May, "because the discharge papers of the last volunteers mustered out of the U. S. Army in the civil war were dated May 30, 1866. This is a mistake. The discharge papers of my own regiment, the 57th U. S. Colored Infantry, were dated at Ft. Leavenworth, Kansas, Dec. 22, 1866, and the 125th U. S. Col'd Inf., but a few weeks before. Nearly all the colored troops were mustered out later than May or June, 1866. The 1st and 3d Regt. N. Mex. Vol. (white) were in the service as late as September, 1866.

The Commander of the G. A. R. set the day for decorating the soldiers' graves on the 30th, because it was thought that flowers would be plenty then, and it would be long enough before the 4th of July not to interfere with any celebration of that day. His choice of the day was adopted by Congress, and some of the states have made it a holiday.

THOS. A. POLLOK, *Miamisburg, O.*

We thank Supt. Pollok for this correction. Our information came from a source that was supposed to be correct, but mistakes are sometimes made by the best of scholars.

EDITOR.

721. When was the site of Cincinnati settled and how did this city get its name?

A. P. S.

ANS.—It was first settled Dec. 28, 1788, and named by Gov. St. Clair, after consultation with Judge Symmes of North Bend, in honor of the Order of Cincinnati, of which both were members. This society was named from Cincinnati, the noted Roman dictator.

EDITOR.

Cincinnati, "the Queen of the West," was founded by New Jersey settlers in 1789. It was laid out by Col. Ludlow, who plotted it on a plan similar to Philadelphia. Its progress was slow until 1816, when steamboat navigation was introduced; since this time it has made rapid strides. It was incorporated as a town in 1802, and as a city in 1819. Its first mayor was Major Ziegler. It was named after the Roman patriot, Cincinnatus, the Roman plural being Cincinnati.

H. A. WOOD.

722. Give sketch of the author of "Curfew must not ring to-night".

ANS.—The poem was written by Mrs. Rosa Hartwick Thorpe, of Litchfield, Hillsdale Co., Mich. It may be found in *Ballads of Bravery*, published by Lee & Shepherd, Boston.

METTLÉ GEORGE.

723. Was the purchase of Louisiana constitutional? Explain.

ANS.—It was not; "Jefferson acknowledged that the Constitution did not authorize the purchase of foreign territory, and intended to appeal to the people to make an amendment to the Constitution, sanctioning the purchase; but there was such a general approval of the act that no such amendment was proposed."—*Alden's Science of Government*.

J. S. HOYMAN.

When France offered Louisiana so cheap Pres. Jefferson held a secret session with his Cabinet and concluded to make the purchase, on the ground that it was a case of necessity, as the pending war between England and France, might induce the English to invade this territory and secure a strong hold in our midst. Authorities say that France had ceded this territory to Spain and had no right to sell it, though it nominally belonged to her. Pres. Jefferson through his ministers to France, James Monroe and Robt. Livingston was entirely excusable for that unconstitutional purchase.

EDITOR.

724. Who was Longfellow's "Beautiful Helen of Maine"? *Id.*

ANS.—Miss Helen Hamlin, who presented to the poet an *Iron Pen*, made from a fetter of Bonnavard, the prisoner of Chili; the wooden handle from the Frigate Constitution, and bound with a circlet of gold, inset with three precious stones from Siberia, Ceylon and Maine. The ten stanzas written by Longfellow to Miss Hamlin on receiving the present, are beautiful and expressive.

EDITOR.

725. Give a short sketch of Queen Elizabeth's affection toward the earl of Essex after his conviction of treason.

ANS.—The queen had formerly given him a ring, directing him to send it to her on any emergency, and it should procure him safety and protection; the bearer, the Countess of Nottingham, betrayed her trust, and purposely delayed giving the token until it was too late to save him. The queen signed the death warrant for his execution and then countermanded it; she again ordered it to proceed, and again recalled it; believing that he would ask for her mercy, she consented to his death. When sensible of his penitence, she fell into a deep despondency, refused food, consolation, and advice, and remained immovably fixed to the floor, venting her grief in sighs and groans; when exhausted, she fell into a sleep from which she never woke, A. D. 1603.

G. L. SHANER.

726. Why will a brunette endure the sun's rays better than a blonde?

WM. S. DAVIDSON.

ANS.—We doubt the truth of the fact implied in the query. If the brunette can endure the heat of the sun's rays better than the blonde, it must be due to the modifying influence of the coloring matter in the Malpighian mucous membrane between the true skin and the scarf skin.

EDITOR.

727. Who discovered mesmerism? Galvanism?

Id.

Ans.—Mesmerism or Animal Magnetism was discovered by Franz (according to others Fredrick Anton Mesmer), about 1772 in connection with Father Helle. In 1775 he published an account of his discoveries. In the year 1780, Luigi Galvani, a physician of Bologna, in making investigations on the serious irritability of cold-blooded animals, discovered by accident that the limbs of a recently killed frog, when hung by the crural nerve on the metal support near an electric machine, contracted convulsively at the recurrence of each spark. This may be properly considered the discovery of Galvanism

J. H. W. SCHMIDT.

728. Who said "Am I on a bed of roses"? Give incident. Id.

Montezuma's successor was Guatimozin, a young nobleman, brave, but unfortunate. He was taken prisoner by Cortez; and to cause him to reveal the place of the imperial treasures, he, with his principal officer of state, was prostrated on a bed of live coals. The chief officer in his agony looked toward his sovereign, as if to ask permission to tell where the treasures were concealed. Guatimozin rebuked him by exclaiming, "Am I on a bed of roses"? This act of cruelty, however, failed of its purpose; and Guatimozin was afterward executed on a charge of plotting an insurrection against his barbarous conquerors.

W. W. Wood.

729. When and by whom was the Christian-Era Dating introduced?

H. A. Wood.

Ans.—It was introduced in Italy in the 6th century by Dionysius the Little, a Roman abbot, and began to be used in Gaul in the 8th, but not generally followed till a century later. Its commencement is the 1st of January in the 4th year of the 194th Olympiad, the 753d from the foundation of Rome, and the 4714th of the Julian period. It is usually supposed to begin with the year in which Christ was born, but the exact date of that event has not yet been established. Prof. Sattler, of Munich, has lately tried to prove that the established method of reckoning the Christian Era is erroneous, and if his calculations are correct the current year should be 1890. See *Britannica*.

EDITOR.

730. How does the length of a common or Statute mile compare with the length of the mile in different countries? Id.

Ans.—The term *mile* is derived from the Roman *Milliare*, which contained 1,000 paces (*mille passuum*) of five Roman feet each. The length of the modern mile is remarkably different in various countries, as may be seen in the following table:

English and U. S. mile.....	1.000	Danish mile.....	4.684
English geographical mile.....	1.153	Hungarian mile.....	5.178
German " ".....	4.611	Swiss mile.....	5.201
Tuscan mile.....	1.027	German long mile.....	5.753
Ancient Scotch mile.....	1.127	Hanoverian mile.....	6.568
Ancient Irish mile.....	1.273	Swedish mile.....	6.648
German short mile.....	3.897	French Kilometer.....	.621
Prussian mile.....	4.680	French mile (<i>Mille Maran</i>)....	1.153
Ancient Roman mile.....	.919	Modern Roman mile.....	.915

EDITOR.

731. Why is it tiresome to walk in miry clay?

NEMO.

Ans.—Because the upward pressure of the atmosphere is partially removed from our feet.

WARREN LOX.

732. How, when and by whom were the equatorial and polar diameters and the circumference of the earth established? Id.

ANS.—Jean Francois Fernel (1497-1558) a distinguished mathematician and doctor of medicine, made the first calculation of the size of the earth. He took Paris as one station and found the angle of elevation of the north Star, thence measured a certain distance north until the elevation of the star was one degree more; hence the distance gone over was one degree and by multiplying by 360 he ascertained the circumference of the earth approximately. Extensive measurements in the decade commencing with 1835 showed a polar depression of nearly .003 of a degree, and thus established the fact that the polar diameter is 26 miles less than the other.

EDITOR.

733. Explain how the flowers of our common clover are fertilized by the bumblebee.

L. B.

ANS.—It is known that clover does not thrive well in localities where the bumblebee is not found. Some honey bees, having a long proboscis, can likewise fertilize the common clover. In each case, while taking the honey dew from the flower, the insect smears the pistil with the pollen of the blossom, and the result is the formation of a seed.

EDITOR.

ANS.—Complete flowers are made up of four parts, two of which, the *stamen* and *pistil*, are essential, while the other two, the *calyx* and *corolla*, are necessary. The *calyx* is that part which surrounds the flower at its outer and lower part. It varies greatly in color and form, but is most frequently of a green or greenish color. Just within the *calyx* is the *corolla*, which usually forms the most attractive, showy, and beautiful part of the flower. Within the cup formed by the calyx and corolla are placed *stamens* and *pistils*, the means (organs) of reproduction of the flower. The *stamen* is composed of a stem or filament, at the summit of which are placed two little sacks called the *anther*, which contains a fine, microscopic dust, the *pollen*, which contains one of the reproductive elements of the flower. The *pistil* occupies the very center of the flower. It produces and contains in a cell the other reproductive element, termed the *ovule*. It is surmounted by the *style* and *stigma*. To insure fertilization it is necessary that the *pollen* and *ovule* of the flowers should be together. In some plants they are found in the same flower but in others they are in different flowers. Bees, moths, and many other species of insects, serve a very important purpose in this work, transporting the fertilizing dust upon their wings and other parts. In this manner the flowers of the common clover are fertilized by the bumblebee.

J. H. W. SCHMIDT.

734. Give the cause of the variation in the color of ocean waters. Of the sky.

Id.

ANS.—The color varies in different places, on account of the difference in depth, amount of mineral salts, and the phosphor essence from minute animalcules. Water over 400 feet deep or containing mineral salts is dark blue while shallower or fresh water is of a pale green. The Arabian and Red seas and the Gulf of California are tinged with red; the Persian Gulf is of a greenish blue; and portions of the Indian ocean present a milk-white appearance.

GALEN.

735. Explain the meaning of "The Truce of God."

Id.

ANS.—Early in the 11th century, owing to constant feuds among the barons, the church proclaimed the Truce of God whereby it became unlawful to wage war on any private account between sunset on Wednesday and sunrise on the following Monday of each week during the whole of Advent, and from the Monday before Ash-Wednesday till Whit-Sunday, as also on all holidays and festivals. The name is drawn from the historic compact in 1040.

EDITOR.

736. How do different kinds of corn mix when planted near each other?

Id.

Ans.—The blossom or tassal is of great importance to corn, as the grain will not form without its help. It sifts down and its vital influence is taken by the silk to the place where the grain starts on the cob. There is a silk for the formation of every grain. It is plain, therefore, that if different kinds of corn are planted near each other the blossom will be blown on the silk of its neighbor, and the result is mixed corn.

EDITOR.

737. Tell who captured Jeff. Davis, and where parties now live.

Ans.—May 10. 1865, Lt. Col. B. D. Pritchard, of the 4th Mich. Cavalry, captured Jeff. Davis, his wife and four children, and a number of attendants, near Irwinsville, Irwin Co., Ga., while they were encamped in a dense pine forest on their flight from the confederate capital. The disguise worn by Mr. Davis at the time of his capture was simply a lady's water-proof and a very costly shawl which it is said was wrapped around his head. Gen. Pritchard formally lived at Parkman, Geauga Co., Ohio, but he is now a resident of Allegan, Mich. Jeff. Davis lives at Beauvoir, Miss., a beautiful home on the Gulf.

EDITOR.

738. Explain simple process by which water may be made to boil by being cooled, and to stop boiling by being heated. Also, how two liquids at the same temperature, may be placed that the one will boil and the other freeze.

J. W. HOUSTON.

Ans.—If a bottle be half filled with water and then heated in a sandbath (pan of sand) on the stove, the water will soon boil and the air speedily driven out by the steam that is formed. If the bottle be now taken from the bath well corked, turned upside down, and a cake of ice placed on the bottle the steam condenses forming a vacuum, and the water will commence to boil violently, and continue to do so until the temperature of the water in the bottle is below that at which it boils in a vacuum. If the ice be removed before this occurs, the vapor will again fill the bottle, exert a pressure on the water and stop boiling; but the boiling may be renewed by replacing the ice. This is a curious and interesting experiment.

If water at the same temperature as the above be put under pressure, it may be made to freeze. Thos. Carnelly succeeded in freezing water in a red hot crucible under a certain pressure. He also found out a few years ago that any solid can be heated by subjecting it to a pressure a little less than a certain critical pressure which varies in different substances. Acting upon this principle he put a lump of ice under an air pump and reduced the ordinary atmospheric pressure on it to a little less than the critical pressure for ice, and the solid block of crystal ice became so hot that it burned the fingers on being touched. By placing ice under sufficient pressure it may be melted, which may be shown by this striking experiment: Lay a block of ice over two beams and over it pass a fine iron wire, twist the ends together, and suspend heavy weights to the wire and the ice will melt beneath it, but as soon as the wire falls in the ice the water above it is relieved from pressure and freezes. In a short time the wire passes through the ice and lets the weights fall, while the ice is not broken, nor is any mark left where the wire passed through.

EDITOR.

739. Give the puzzle of the "Christians and the Turks."

Ans.—A ship was caught in a storm at sea, and it was determined to throw overboard half the crew and thus save the ship. There were thirty passengers, half Christians and the other half Turks. It was agreed that all should stand in a row and every ninth man be thrown overboard. The puzzle is to arrange the thirty in a row, so that by this device all the Turks may be thrown into the sea. The required arrangement is

4 C, 5 T, 2 C, 1 T, 3 C, 1 T, 1 C, 2 T, 2 C, 3 T, 1 C, 2 T, 2 C, 1 T.

If you cast out successively every ninth letter, which will always be a T—Turk, fifteen C's—Christians will remain.

EDITOR.

740. To whom is the invention of guns attributed?

ANS.—According to some Chinese chronicles, mentioned by M. Paravay in a report made to the French Academy in 1850, guns were known as early as 618 B. C. According to Conde's history, guns were used in 1118, at the siege of Taragassa. The invention of portable fire-arms, or guns proper, is attributed to the Italians; and Sir Samuel Meyrick, in a paper in the *Archæology* of the Society of Antiquaries, names the year 1430 as the year of their introduction. The rifle was invented at Leipsic in 1498.

H. A. WOOD.

741. Who was the "Log-Cabin Candidate" for president? The "Wonderful Doctor"? What is meant by "Plymouth Rock"?

S. A. SMITH.

ANS.—William Henry Harrison was called "Log Cabin Candidate" for president; ridiculed by his opponents from his simple frontier life.

"The Wonderful Doctor" was Roger Bacon, a celebrated philosopher, and mathematician of the 13th century, who, by the power of his genius and the extent of his learning, raised himself above his time, and contributed much to the extension of real knowledge.

The spot where the *Pilgrims* or *Puritans* landed on the bleak shores of New England, Dec. 21, 1620, has been called *Plymouth Rock*.

W. W. WOODS.

742. Give a lucid account of the following events: (a) The humbling of Henry IV. by Pope Gregory VII. at Canossa (1077). (b) Removal of the papal see to Avignon (1309). (c) Great schism of the West; Urban VI. at Rome; Clement VII. at Avignon (1379). (d) Council of Pisa and the three popes (1409).

J. W. DEBERY.

ANS.—(a) Those familiar with the degradation of the popes from Stephen VII., 896-897, who is remembered only for the inhuman treatment of the lifeless corpse of his predecessor Formosus, by digging up the body, cutting off its head and casting it into the Tiber—to Benedict IX. (1033-1045), who sold the pontifical office to John, the arch-presbyter, (Gregory VI.), in order to win the hand of a lady for whom he had conceived a passion, will remember that Henry III. Emperor of Germany was solicited by a party of the Roman Church to intervene between decency and shame. He forthwith crossed the Alps and in his council at Sutri the claims of the three rival popes Gregory VI., Benedict IX., and Sylvester III., were severally examined and pronounced invalid, and Clement II. elected to office. From this a line of German popes proceeded but their tenure of office was brief, on account of being poisoned. Leo IX. (1049-54) being nominated by the emperor, refused to enter upon his office, through advice of the great Hildebrand (Pope Gregory VII.) until his election had been ratified by the vote of the clergy and the people. In conjunction with this faithful adviser, Leo instituted measures by which to suppress simony and other corruptions among the clergy. From that time on to Alexander II. (1061-73) Hildebrand the arch-deacon, guided the popes in all the vexed questions of church discipline; and in 1073 he himself succeeded to the office as Gregory VII. (1073-85). In the mean time Henry IV., who was crowned German king at four years of age (1054), experienced a troublesome reign after the death of his father in 1056. Pope Gregory VII. determined to make the papacy supreme over all earthly authorities. In 1075 Henry had succeeded in overcoming a rebellion among his subjects who had plotted to murder him, and encouraged by the prospects of asserting the ascendancy which had been exercised by his father, he appealed to Gregory VII. to degrade those prelates who had associated themselves with the rebels. Instead of responding favorably the pope sent a papal embassy early in 1076, to Henry, at Goslar, citing him to appear personally at Rome, and there answer for his simony, sacrilege and oppression. This enraged Henry and he insulted the legates. At a diet held at Worms Jan. 24, 1076, he replied by declaring Gregory deposed on charges of tyranny, magic and adultery. Gregory lost no time in excommunicating all the bishops who attended the diet of Worms and solemnly deposed

and excommunicated the emperor. This counter action had a powerful effect on the German princes and people, and at a diet held at Tribur (Sept. 1076) the election of a new emperor was discussed. Resistance being impossible, Henry resolved upon humbling himself to the utmost, and in the dead of winter he set out to make his submission; Gregory was in waiting for him at Canossa, where (Jan. 25-27, 1077) that famous penance which burned itself into the memory of Europe, was imposed. For three days in cold weather, Henry IV., the representative of the Caesars, stood shivering in the outer court of the Countess Mathilda's castle, clothed in a penitent's shirt, entreating to be admitted into the pope's presence. Finally, when no mode of escape than complete subjection was possible, the humiliated king lay at the feet of the pope to implore his pardon, but it did not save him. Although the pope apparently forgave him, the German princes, eager to use the opportunity which fortune had given them, met in his absence and deposed him, and elected Rudolf, duke of Swabia, as his successor. But Henry's humiliation made a man of him, and he determined to maintain his rights. The war of investitures which followed was the opening of that tremendous struggle between the empire and the papacy, which is the central fact of mediæval history, and which after two centuries of conflict, ended in the exhaustion of both powers.

(b) Philip IV., the "Fair", was a French monarch noted for his formidable system of taxation, by which he seized all he could, wrung the Jews, confiscated the wealth of the Templars, etc., and by sumptuary laws succeeded to tax even his nobles. This state of need and greed brought on the great strife of his reign, the quarrel with pope Boniface VIII. (1295-1303). This was a many-sided struggle, that of the temporal against the spiritual authority; that of the civil against the canon law; that of the lawyers against the clergy; that of France against Italy. In the year of jubilee, (1300), matters being reconciled, Boniface seemed to be above all the princes and potentates of the earth. He appointed as his legate in France bishop Saisset, who was a foe to the French crown. He used his authority to stir up strife, and Philip IV. arrested him as a traitor. This kindled a struggle in which the resolute French monarch repelled the papal pretensions and finally reduced the Roman see to a mere instrument of his will. This humiliation and sense of defeat hastened the death of Boniface, and with his departure the papacy of the Middle Ages fell. In the year 1305 Clement V. (1305-14) became pontiff. He was invested with the tiara (the popes triple crown) at Lyons, and 1309 transferred his court from Rome to Avignon. The pressure put upon him by King Philip and a desire to escape from the strife then waging between the two factions, the Orsinis and the Colonnas, at Rome, are the causes given for this step. For a period of nearly seventy years, pope after pope held his court at Avignon, derisively styled the "Babalonian captivity."

(c) The outbreak of the great schism in the west struck deeply at the sentiments of veneration which had been wont to gather around the pontiff's chair. The papacy being degraded to a state of splendid vassalage to France, the good will of England and Germany was entirely alienated from them. Clement V. assisted Philip IV. in his infamous suppression of the Order of Templars, and the barbarous cruelties inflicted on the noble victims aroused the aversion of the people. The traffic in benefices and the acquisition of wealth and territory were concomitant with the sinking of the moral influence of the papacy to its lowest ebb. England and Germany took measures to check this system of wild extortion and corruption. The insubordinate religious order, called Fraticelli, rose at this time to protest against the appalling degeneracy of the papacy, while great scholars in the universities brought the tenets of the schools to bear on this system of popedom. On the death of Gregory XI. in 1378, it was probable that another Frenchman might be elected. The citizens of Rome became intensely interested in the election, because the removal of the curia from the capital to Avignon had caused large streams of wealth toward the latter. In order to appease these people, the terrified college of car-

dinals, the body that elected the pope since the change of the election, by decree of the second Lateran council (1059), elected an Italian, Prignani, who assumed the title of Urban VI. Intoxicated by his sudden fortune, this pope assumed such arrogance of demeanor and lacked self-control, that the cardinals plead intimidation in his election, and pronounced it invalid. They then proceeded to elect one of their own number, Robert of Geneva, known as Clement VII. (1378-94). For thirty-eight years, Europe was scandalized by the contentions of two rival popes, each hurling the foulest accusations at the other, and compared by Wycliff to "two dogs snarling over a bone."

(d) In the 15th century an endeavor was made to prevail on both popes—Gregory XII. at Rome and Benedict XIII. at Avignon, to renounce their claims and restore church union, but the popes evaded this proposal persistently. The cardinals attached to either court met at Leghorn, and agreed to call a general council at Pisa, March 25, 1409. The doctors of the canon law and of theology from the universities of Oxford and Paris decided a general council thus summoned was superior to the authority of the pope, and accordingly the two rival popes were deposed, and both bodies of cardinals formed a conclave and elected Alexander V. (1409-10).

EDITOR.

743. Is the equator a circle? If not, explain.

COSMOS.

ANS.—It has been recently shown that the equator itself is not a perfect circle, but is somewhat flattened, since the diameter which pierces the meridian 14° east of Greenwich is two miles longer than the one at right angles to it. But it may not be wise to put too much confidence in this theory until it has been more decisively tested.

WARREN LOY.

744. Who was the author of the Ordinance of 1787?

ID.

ANS.—In 1784 Thos. Jefferson introduced in Congress a comprehensive measure for the government of the Northwest Territory, from which ten states were to be formed. It was passed but remained a dead letter. In 1786 the people of Kaskaskia petitioned for a territorial government, and Congress adopted a code of laws for a temporary government, May 10, 1787, aptly called the Ordinance of Freedom. But at this juncture the Rev. Manasseh Cutler of Ipswich, Mass., came before Congress as the agent of the Ohio Land Company. He wished to purchase for that company several million acres of land in this territory. He was a ripe scholar, a distinguished divine, an eloquent speaker and a wily diplomatist. Through his influence Gen. St. Clair, then President of Congress, appointed a committee July 9, 1787, consisting of Col. Carrington, as chairman, Richard Henry Lee, of Va., Nathan Dane, of Mass., Mr. Kean, of S. C. and Mr. Smith of N. Y., to prepare an ordinance. They produced this famous Ordinance of 1787, submitted it first to Dr. Cutler for his amendment, then introduced it to Congress, had it read, amended, and procured its passage July 13, and it became a law at once. Oct. 5, the officers of the new territory were elected, and Gen. St. Clair became its first governor. This Ordinance ranks among the grandest bill of rights ever produced for the government of any people. See Article by William W. Williams in *Magazine of Western History*, for Nov. 1884.

EDITOR.

Credits for answers not published.

HATTIE HARPER, *Horatio, Ohio*, 743, 744.

CLARA RUBEK, *West Sonora, Ohio*, 741.

MYRTLE GEORGE, *Gettysburg, Ohio*, 727, 736.

JOHN KNIESLY, " " 721, 727.

J. H. W. SCOMIDT, *Ansonia, Ohio*, 744.

JAMES A. COTTELL, *North Star, Ohio*, 721.

J. S. HOYMAN, *Clarksville, Ohio*, 744.

WARREN LOY, *Pyrmont, Ohio*, 721, 728, 737.

W. W. WOODS, *Bloomertown, Ohio*, 721, 728, 736, 741, 743, 744.

GEO. L. SHANER, *Stewart's Station, Pa.*, 723, 729, 737, 741.

QUERIES.

784. What is the *Circle of Illumination*? S.
 785. Is Geo. Bancroft living? If so, where? U.
 786. Why was the eagle chosen emblem of the U. S.? L. M. O.
 787. What was the "X-Y-Z Treaty"?
 788. Whence came the superstitious fear of spilling salt?
 789. Who made the first marine chronometer? W.
 790. Describe the "Gigantic Silver Fountain."
 791. How many asteroids, discovered up to the present?
 792. Will a fire burn more rapidly at night? Why?
 793. Name the best English writers on Education. FAY.
 794. Who have written standard histories of the U. S.?
 795. Who was Copernicus? What did he teach?
 796. Give causes that led to the downfall of Rome.
 797. What and when was the "Thirty-years' War"? G. S.
 798. Who were the five greatest generals of modern times?
 799. What writer was called *the tree of life*? J. H. W.
 800. What country is called the *Land of Health*?
 801. What was Alfred's Jewel?
 802. What was "the Eagle of the doctors of France"?
 803. Was Christmas-day ever abolished by Parliament?
 804. Name the old man who rang the Liberty Bell, July 4, '76.
 805. What Senator was dismissed after 2 months service? Why?
 806. What is there now to commemorate the spot where Washington took the oath as first President? W.
 807. Give place and incidents of the first meeting, or organization of the Society of American Foreign Missions.
 808. What was engraved upon the memorial window presented to Williams College by Cyrus W. Field, in honor of James B. Garfield?
 809. What political names are given to the U. S. Flag, and why so given? L. M. O.
 810. Who is the author of the oft-repeated expression "and still they come"?
 811. Where are the richest deposits of salt and alum in the U. S.?
 812. What U. S. Senators were known as "Miss Nancy" and "The Ohio Gong"? Why?
 813. Is the ostrich egg the largest among birds' eggs?
 814. Robert R. Livingstone was one of the five men who drafted the Declaration of Independence. Why does he not appear as a signer of that immortal document? J. S. H.
 815. Is there a property or an educational qualification for voting in any state of the Union?
 816. What principles does the order of Cincinnati advocate?

Answers should be received on or before Dec. 5.



EDITED BY

JOHN S. ROYER.

VOL. VI.

DECEMBER, 1885.

No. 12

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

801. *By J. C. ROEBUCK, Rock Falls, Iowa.*—Find three numbers such that the sum of any two, and also the difference of any two, shall be a square number.

By A. L. FOOTE, Hempstead, N. Y.

We will first assume three square numbers, the difference of any two of which shall be a square number. Let x^2 , y^2 and z^2 be the numbers. Then $x^2 - y^2 = m^2$, $x^2 - z^2 = n^2$, and $y^2 - z^2 = p^2$. Let $y = (q^2 - r^2)x \div (q^2 + r^2)$ and $z = (s^2 - t^2)x \div (s^2 + t^2)$. It will then remain to make $y^2 - z^2$ or $(q^2 - r^2) \div (q^2 + r^2) - (s^2 - t^2) \div (s^2 + t^2) = p^2$ a square. Expanding, we have $(q^2 - r^2)(s^2 + t^2) + (q^2 + r^2)(s^2 - t^2) = \square$; from which $2(q^2s^2 - r^2t^2) \times 2(q^2t^2 - s^2r^2) = \square$. Now put $q^2 = v^2r^2$ and $t^2 = w^2s^2$, and the foregoing becomes $4(v^2r^2s^2 - r^2w^2s^2) \times (v^2w^2s^2r^2 - r^2s^2) = \square$. Dividing this by the square factor $4r^2s^2$, we have $(v^2 - w^2)(v^2w^2 - 1) = \square$, in which, if we take $w = \frac{4}{5}$ and $v = \frac{1}{4}^3$, and substitute these values, we find $q = \frac{1}{4}^3r$ and $t = \frac{4}{5}s$; $\therefore z^2 = (s^2 - t^2)x^2 \div (s^2 + t^2)$, and substituting the numerical values, we have $y^2 = (\frac{1}{8}\frac{5}{8})^2x^2$ and $z^2 = (\frac{1}{4}\frac{1}{4})^2x^2$, in which, if we assume $x = 153$, we have $y = 185$ and $z = 697$, the squares of which will fulfil the conditions above required; viz., $x^2 = 23409$, $y^2 = 34225$, and $z^2 = 485809$.

Now to find the numbers, such that the sum of any two shall also be a square number. Let x_1 , y_1 , and z_1 be the numbers; then we must have the conditions $x_1 + y_1 = a^2$, $x_1 + z_1 = b^2$, and $y_1 + z_1 = c^2$, whence, by subtraction, we have $x_1 - z_1 = a^2 - c^2$, $x_1 - y_1 = b^2 - c^2$, and $y_1 - z_1 = a^2 - b^2$. Here we require just such values of a , b , c , as will fulfil these last conditions, and the former must necessarily follow. But in the numbers found in the first case above, we have such numbers. Considering these as known, we have $x = \frac{1}{2}(a^2 + b^2 - c^2) = \frac{1}{2}(485809 + 34225 -$

$23409) = 248312\frac{1}{2}$, $y = \frac{1}{2}(a^2 + c^2 - b^2) = \frac{1}{2}(485809 + 23409 - 34225) = 237496\frac{1}{2}$, and $z = \frac{1}{2}(b^2 + c^2 - a^2) = \frac{1}{2}(34225 + 23409 - 485809) = 214087\frac{1}{2}$. If we multiply each of these by 4, we shall have the integral values, 993250, 949986, and 856350, which numbers answer the conditions.

802. By L. G. KUHN, *Strasburg, Ohio*.—How many cubic feet in a stone 32 feet high, whose base is a rectangle, 10 feet by 4 feet, and also the top 8 feet by $1\frac{1}{2}$ feet?

By A. L. FOOTE, *Hempstead, N. Y.*

If from each end at the top of the stone it is cut by a perpendicular plane at right angles to the sides the two parts thus cut from the stone being joined together by the union of the perpendicular plane of each, form a wedge whose base is 4 feet by 2 feet, height 32 feet and length of edge $1\frac{1}{2}$ and its solidity is $\frac{1}{6}[(4 \times 2) + 1\frac{1}{2}] \times 32 \times 2 = 101\frac{1}{3}$ cubic feet. Again we may now have in like manner two wedges from the sides which similarly joined, form a wedge whose base is 8 feet by $2\frac{1}{2}$ feet, height 32 feet and length of edge 8 feet; solidity $= \frac{1}{6}[(8 \times 2) + 8] \times 32 \times 2\frac{1}{2} = 320$ cubic feet. We then have remaining a prism whose base is 8 feet by $1\frac{1}{2}$ and height 32 feet. Solidity $= 8 \times 1\frac{1}{2} \times 32 = 384$ cubic feet, whence $101\frac{1}{3} + 320 + 384 = 805\frac{1}{3}$ cubic feet, entire solidity. Or thus by Prismoidal Formula

$$\frac{1}{3}[(10 \times 4) + (8 \times 1\frac{1}{2}) + \frac{1}{2}(10 + 8) \times \frac{1}{2}(4 + 1\frac{1}{2})] \times 32 \div 6 = 805\frac{1}{3} \text{ cu. ft.}$$

Solved by William Wiley.

803. By A. J. LILLY, *Dixon, Ill.*—Two parallel planes divide a sphere whose diameter is 36 inches, into three equal segments; required the altitude of each.

By WM. WILEY, *Detroit, Mich.*

For the sake of small numerals, let radius be 1, and let x = height of segment. The volume of the sphere is $\frac{4}{3}\pi$; $\therefore$ we have $\pi x^2 - \frac{1}{3}\pi x^3 = \frac{4}{3}\pi$ or $x^2 - \frac{1}{3}x^3 = \frac{4}{3}$, from which $x = .773923$. Multiplying by 18 the height of each of the outside segments is 13.930614, and the height of the center segment is the remainder of the diameter or 8.138772.

By A. L. FOOTE, *Hempstead, Long Island.*

Let x = height of each of segments of one base and r = radius of sphere = 18 in. Then for its solidity we have $\pi x^2(r - \frac{1}{3}x)$ which by the conditions $= \frac{1}{3}\pi(2r)^3 \div 3$, or $\pi r x^2 - \frac{1}{3}\pi r x^3 = \frac{4}{3}\pi r^3$ which after clearing of denominators, and reducing becomes $x^3 - 54x^2 = -7776$, from which we find $x = 13.9306$ + inches, and height of the middle segment $= 36 - (13.9306 + \times 2) = 8.1388$ + inches.

H. C. Bickle also solved it.

804. What is the longest strip of carpet one yard wide, that can be laid in a room 30 feet by 20 feet?

By A. L. FOOTE, *Hempstead, N. Y.*

Let $ABCD$ represent the room and $EFGH$ the strip of carpet. Let $BF=x$, $EF=3$ feet, and $BE=\sqrt{(9-x^2)}$. By similar triangles $EF:BE::EH:AH$, we also have $EF:BF::EH:AE$, and consequently, $BE:AH::BF:AE$; or we have



$\sqrt{(9-x^2)}:20-x::x:30-\sqrt{(9-x^2)}$. Resolving the proportion into an equation, we have $-2x^2+20x+9=30\sqrt{(9-x^2)}$. Squaring, $4x^4-80x^3+1264x^2+360x=8019$. Solving by Horner's method, $x=2.5571+$, and $\sqrt{(9-x^2)}=1.5689$, $AH=20-x=17.4429$, $AE=30-\sqrt{(9-x^2)}=28.4311$, and $EH=\sqrt{(AE^2+AH^2)}=33.3554$ ft., 11.1185 yd.

Solved by William Wiley.

805. By H. L. HARVEY, *Marfield, Me.*—Required the duration of twilight at 45° north latitude, Dec. 21.

By PROF. WILLIAM HOOVER, *Ohio University, Athens, Ohio.*

Put z =the zenith distance, δ =the declination, h =the hour angle of any heavenly body, and ϕ =the latitude of the observer. Then $\cos z = \sin \phi \sin \delta + \cos \phi \cos \delta \cos h \dots (1)$. When the morning twilight begins, $z = 108^\circ = a$, and (1) gives $\cosh = (\cos a - \sin \phi \sin \delta) \div \cos \phi \cos \delta \dots (2)$. Putting $\sin \delta = \tan \theta \cos a \dots (3)$, and $\sin \phi = \tan \theta' \dots (4)$, (2) becomes $\cosh = [\cos a \cos(\theta + \theta')] \div \cos \delta \cos \phi \cos \theta \cos \theta' \dots (5)$. Taking for the declination of the sun Dec. 21, Hansen's value of the obliquity of the ecliptic used in the Nautical Almanac, $\delta = 23^\circ 27' 31''$, (3) and (4) give $\theta = 52^\circ 10' 45.7''$, $\theta' = 35^\circ 15' 51.8''$. These in (5) give $h = 92^\circ 25' 44''$, the hour angle of beginning of twilight. Let h' =the hour angle of sunrise, when $z = 90^\circ$; and then (1) gives $\cosh' = -\tan \delta \tan \phi \dots (6)$. Noticing that ϕ is positive and δ negative, we find $h' = 64^\circ 16' 53''$. The duration of twilight $= h - h' = 28^\circ 8' 51''$, reduced to time is 1 hr. 52 min. 35.4 secs.

Solved by William Wiley and H. C. Bickle.

806. By WM. WILEY, *Detroit, Mich.*—Find the integral right triangle whose area is 6 times the sum of its sides.

By HON. JOSIAH H. DRUMMOND, *Portland, Me.*

Let $6=p$, then taking Judge Scott's expressions for right angled triangles with integral sides, we have m^2+n^2 , m^2-n^2 , and $2mn$; for the perimeter $2m(m+n)$ and for the area $mn(m^2-n^2)$; hence

$2pm(m+n)=mn(m^2-n^2)$ or $2p=n(m-n)$, and $m=(n^2+2h)\div n$.

It is now evident upon inspection that this value of m will be integral when $n=1, 2, p$, or $2p$, and the corresponding values of m are $2p+1$, $p+2$, $p+2$ and $2p+1$; so that we have four triangles answering the conditions of the question for each value of p ; but in some sets there will be two alike, so that for some values of p we have only two or three different triangles. Substituting the values of m and n in the original expressions we have

1. $2(2p+1)$, $4p(p+1)$, $4p(p+1)+2$ for the three sides.
2. $4(p+2)$, $p(p+4)$, $4(p+2)+p^2$ " " " "
3. $2p(p+2)$, $4(p+1)$, $2p(p+2)+4$ " " " "
4. $4p(2p+1)$, $4(p+1)$, $4p(2p+1)+1$ " " " "

Taking $p=1$, we have two triangles with sides 6, 8, and 10, and 12, 5, 13, respectively; taking $p=2$, we have three triangles with sides 10, 24, and 26; 16, 12, and 20; and 40, 9, and 41; taking $p=3$, we have four triangles with sides 14, 48 and 50; 20, 21 and 29; 30, 16 and 34; 84, 13 and 85. To give integral values, p must be integral, except that any odd number divided by two will give integral values for two of the four triangles in each set; thus if p be $\frac{1}{2}$ the sides are 3, 4 and 5 and the area equals half the perimeter.

By J. C. CORBIN, Pine Bluff, Ark.

If $3x$, $4x$, and $5x$ are the sides, then

$(3x \times 4x) \div 2 = 6 \times (3x + 4x + 5x)$, or $6x^2 = 72x$; hence $x=12$, and the sides are 36, 48 and 60.

808. *By PROF. DEVOLSON WOOD, Hoboken, N. J.*—A body is free to rotate about its horizontal axis of symmetry, in a circular groove of which is wound a fine string, the free end of which is h feet below the tangent point of the string. An animal whose mass is m starts at the free end and crawls up the string at a uniform rate relatively to the string; required the rate so that he will just reach the tangent point, and how far below it will he be at the end or a given time?

By PROF. WM. HOOVER, Ohio University, Athens, Ohio.

Let M =the mass of the rotating solid, K =the radius of gyration about its axis of symmetry, a =the radius of the circular groove, P be the point of tangency of the string and solid, ϕ =the angle swept over by the initial radius through P in any time t from the beginning of motion, x =the distance of the animal from P at the same time, v =the constant velocity of the animal, t_1 =the time required to reach P , and x_2 =the distance from P in the time t_2 .

Taking moments about the center of the groove

$MK^2(d^2\psi \div dt^2) \dots (1)$. Integrating twice, observing that when $t=0$ $d\psi \div dt=0$, and $\psi=0$, $MK^2\psi=-\frac{1}{2}magt^2$ or $a\psi=(ma^2gt^2) \div 2MK^2 \dots (2)$

Throughout the motion,

$$x=a\psi+h-vt=(ma^2gt^2) \div 2MK^2+h-vt \dots (3)$$

When $t=t_1$, $x=0$, and (3) gives $v=(ma^2gt_1^2+2MK^2h) \div 2MK^2t_1$, the required constant velocity for reaching the point P in a given time t_1 .

Substituting this value of v in (3), and noticing that when $t=t_2$, $x=x_2$

$$x_2=(ma^2gt_2^2) \div 2MK^2+h-[(ma^2gt_1^2+2MK^2h) \div 2MK^2] \cdot (t_2) \div t_1,$$

which is the second requirement of the problem.

809. By J. C. CORBIN, *Little Rock, Ark.*—A circle is inscribed in an isosceles triangle, whose altitude is one-half its base. Prove, that the radius of the circle, divided by the altitude of the triangle, equals the fractional part of $\sqrt{2}$.

By HON. JOSIAH H. DRUMMOND, *Portland, Me.*

Let a =altitude; then $2a$ =base, and each of other sides is $\sqrt{a^2+a^2}=a\sqrt{2}$. The area of the triangle is a^2 . The area divided by the perimeter=one half radius of inscribed circle, therefore the radius= $2a^2 \div (2a+2a\sqrt{2})=a \div (\sqrt{2}+1)$. Thus divided by a (the altitude)= $1 \div (\sqrt{2}+1)$; multiplying numerator and denominator by $\sqrt{2}-1$ we have $\sqrt{2}-1 \div (\sqrt{2}-1)=\sqrt{2}-1$, but the square root of 2 is one + a fraction, hence $\sqrt{2}-1$ =the fractional part of the root.

Solved by Wm. Wiley, A. L. Foote and H. C. BICKLE.

810. By PROF. WM. HOOVER, *Athens, Ohio.*—If v be the vertical angle of any plane triangle, a , the sum of including sides, and b , the base, show that the sines of the angles at the base are to each other as

$$a-\sqrt{[b^2-(a^2-b^2)\tan^2\frac{1}{2}v]} : a+\sqrt{[b^2-(a^2-b^2)\tan^2\frac{1}{2}v]}.$$

By the PROPOSER.

Let ψ and $\pi-(\psi+v)$ be the angles adjacent to the base. The half difference of these is $\frac{1}{2}[(2\psi+v)-\pi]$. By Trigonometry we have $\cos[\frac{1}{2}(2\psi+v)-\frac{1}{2}\pi]=a \div b \sin \frac{1}{2}v$, or, developing the first member $\sin(\psi+\frac{1}{2}v)=a \div b \sin \frac{1}{2}v$, or $\sin \psi \cos \frac{1}{2}v + \cos \psi \sin \frac{1}{2}v = a \div b \sin \frac{1}{2}v$, whence $\sin \psi \cos \frac{1}{2}v = (a \div b - \cos \psi) \sin \frac{1}{2}v \dots [A]$.

Squaring, dividing by $\cos^2 \frac{1}{2}v$, transposing and arranging, we have $\sec^2 \frac{1}{2}v \cos^2 \psi - [(2a \tan^2 \frac{1}{2}v) \div b] \cos \psi = (b^2 - a^2 \tan^2 \frac{1}{2}v) \div b^2$, a complete quadratic equation for $\cos \psi$. We easily find by solving it that $\cos \psi = \{a \tan^2 \frac{1}{2}v + \sqrt{[b^2 - (a^2 - b^2) \tan^2 \frac{1}{2}v]}\} \div b(1 + \tan^2 \frac{1}{2}v)$. Substituting in $[A]$ $\sin \psi = \{a - \sqrt{[b^2 - (a^2 - b^2) \tan^2 \frac{1}{2}v]}\} \div b(1 + \tan^2 \frac{1}{2}v)$. Multiplying the last two equations by $\sin v$, $\cos v$ respectively, adding the resulting equations together, and reducing, $\sin(\psi+v) = \sin[\pi - (\psi+v)]$.

$$= \frac{1}{2}a + \sqrt{[b^2 - (a^2 - b^2)\tan^2 \frac{1}{2}v]} \div b(1 + \tan^2 \frac{1}{2}v).$$

$$\therefore \sin \phi : \sin[\pi - (\phi + v)] : : a - \sqrt{[b^2 - (a^2 - b^2)\tan^2 \frac{1}{2}v]} : a + \sqrt{[b^2 - (a^2 - b^2)\tan^2 \frac{1}{2}v]}.$$

811. *By J. W. JONES, Circleville, Ohio.*—A body weighing 5 lb. descends vertically, and draws a weight of 6 lb. up an inclined plane of 45° . How far will the first body descend in ten seconds?

By PROF. WM. HOOVER, Ohio University, Ohio.

Put m = the mass of the first weight, m' = the weight of the other, $g = 32\frac{1}{2}$ = the acceleration of gravity, x and x' the distances from the vertex of the inclined plane of m , m' at the end of any time t , l = the length of the inextensible, perfectly flexible string connecting m and m' , T = the tension of the string, and $45^\circ = a$. Then for the motion of m , $m(d^2x) \div dt^2 = mg - T \dots (1)$. For the motion of m' , resolving parallel to the plane, $m'(d^2x') \div dt^2 = mgsina - T \dots (2)$. Eliminating T from (1) and (2), $m(d^2x) \div dt^2 - m'(d^2x') \div dt^2 = mg - m'gsina \dots (3)$. But $x + x' = l$; $\therefore (d^2x') \div dt^2 = -(d^2x) \div dt^2$, and (3) becomes

$$(m + m') \frac{d^2x}{dt^2} = mg - m'gsina \dots (4). \quad \text{Integrating (4) twice,}$$

remembering that when $t = 0$, $(dx) \div dt = 0$, and $x = 0$,
 $x = [\frac{1}{2}(mg - m'gsina) \div (mg + m'g)] \cdot gt^2$. But $mg = 5$ lbs., $m'g = 6$ lbs.;
 $\therefore x = 110.7351105$ ft., the required distance.

Solved by William Wiley.

812. *By S. G. CAGWIN, New London, N. Y.*—In the latitude of 30° and 50° north, on the same meridian, in the morning of June 21, it is required to determine the exact instant when the sun's altitude will be equal, if observed at both places and find the altitude at that time.

By PROF. WILLIAM HOOVER, Athens, Ohio.

If z = the zenith distance, d = the declination, and h = the hour angle of a heavenly body, and ϕ = the latitude of the observer, $\cos z = \sin \phi \sin d + \cos \phi \cos d \cos h$. If we place $\phi' = 30^\circ$, $\phi'' = 50^\circ$, we have by the problem,

$$\cos z = \sin \phi' \sin d + \cos \phi' \cos d \cos h = \sin \phi'' \sin d + \cos \phi'' \cos d \cos h,$$

whence $\cos h = \cot \frac{1}{2}(\phi'' + \phi') \tan d$. Neglecting the hourly changes in d and taking Hansen's value of the obliquity of the ecliptic used in the Nautical Almanac for 1885 for d , June 21, or $d = 23^\circ 27' 31''$, we find $h = 3$ hrs. 55 min. 26 sec. before noon of either place. Substituting h in arc in either of the equations for $\cos z$, we find $z = 52^\circ 25' 3''$, the complement of which, $37^\circ 34' 57''$, is the altitude required.

Solved by William Wiley and the Proposer.

Biographical Sketches of Contributors.

The following contributors solved all the September problems:

S. F. ATWOOD, *Flacraft, Me.*, is a carpenter and devotes his spare moments to the study of mathematics. He solves nearly all the problems in the *Visitor*, but has not been sending solutions. We gladly welcome him as a contributor.

F. P. STAUFFER, *Stelvideo, Ohio*, is 23 years old, and ascribes his success in mathematics to the study of the *Visitor*. He is a successful teacher, engaged the second year at Stelvideo.

JOSEPH F. KULL, *Enterprise, Ohio*, is a native of Hocking Co., commenced teaching when he was 18, and taught every winter for 8 years. He is self-made and is thorough in what he has done.

C. W. HEIRONIMUS, *New Madison, Ohio*, is self-educated and industrious. He was born in 1856, and spent his life on the farm, teaching in the winter and having an experience of 45 months.

R. A. LEISY, *Burton City, Ohio*, is a teacher and gives evidence of mathematical skill. He is only 17 years old, having been one of Mr. Leahy's pupils.

GEORGE W. LEAHY, now principal of schools at Marshallville, Ohio, was born July 4, 1858. He is of Irish descent, and studied the higher branches while working in the coal mines and clerking in his brother's grocery. He had very little schooling, but he has done remarkably well in gaining an education. He has taught 7 years, and has been one of the *Visitor's* early and substantial friends.

B. F. FINKEL, *North Lewisburg, Ohio*, speaks highly of our magazine, as a medium through which he became acquainted with valuable methods of solving problems, and with mathematicians whom he admires. He has become familiar with Algebra, Geometry, Trigonometry and Astronomy, and taught mathematics in the Normal Institute at Amanda, Ohio, last summer. He has been teaching a few years and renders good satisfaction. His age is 20.

J. H. W. SCHMIDT, *Ansonia, Ohio*, was one of our esteemed pupils, and graduated from the Ansonia High School while we were Principal. His progress was truly astonishing. He has taught nearly five years, two of which were in the Capital-University district, near Columbus, and in conjunction with his school work there, he pursued the classical course in said University, reaching the Junior year. His health would not permit such intense mental exertion, and he is now teaching near his parental home.

D. W. K. MARTIN, *Versailles, Ohio*, was another pupil of ours about 16 years ago. He has since taught with success, and filled the position of Principal in the Versailles and the Bradford Schools. He has mathematical skill, and delights in analytical work. He is about thirty-five years old and has a family. He was reared on the farm and received a common school education. By industry and original investigation he has acquired scholastic attainments.

MARTIN RICE, *Lone Jack, Mo.*, author of *Rural Rhymes*, is a new acquaintance of the *Visitor*. He was born in East Tennessee Nov. 22, 1814. His life work has been on the farm, propagating trees, surveying land, and writing poetry. His favorite study was mathematics in which he claims to have discovered some things not "laid down in the books". We have from his pen an ingenious problem, being an expansion of the Pythagorean proposition.

ALEX. CRAWFORD, A. M., Prin. of High School, *Como, Miss.*, is a teacher of 14 years experience. He is a native of Va., and his folks still live in the beautiful Shenandoah Valley. He was educated at Emory and Henry College, Va., and began teaching in the Natchez (Miss.) Institute, and in a few years became its superintendent. In a few years afterward he went to Texas to a more lucrative position, lost health and returned to Va. where he spent two years in retirement. He has been doing a good work for several years at Como.

L. A. MATHIAS, M. D., *Enterprise, Ohio*, is a useful and influential citizen of Hocking Co. He was born in 1851, reared on the farm, and taught a short time. He began the study of medicine in 1876 and graduated with the class of '79 in Columbus Medical College. He practiced medicine till '82, when failing health compelled him to retire to the farm, where he is enjoying all its immunities. He raised the largest club for the *Visitor* this year, nearly all from his county, where there seems to be a live, educational spirit.

WM. TATE, *Greenwich, Ohio*, was born in Canada of Scotch parents, and received his early education in London. He has taught nine years and owns the *Greenwich Enterprise*, a bright local newspaper. He came to the United States at thirteen, and till eighteen had served as dry goods clerk, harnessmaker, baker, and section hand on railroad. At nineteen he began teaching and likes it so well that he intends to make it his business for life. He works hard and may his labors be attended with corresponding success.

JOHN C. GREGG, A. M., *Brazil, Ind.*, is a thorough scholar and a very successful teacher, having taught eighteen years, and this is his 7th year as superintendent of the schools at Brazil. He graduated from Monmouth (Ill.) College in 1865, and was honored with the degree of Master of Arts by Miami University and his Alma Mater both. He is rather ingenious and generally original in his mathematical investigations, possessing a great love for the "bewitching science". The *Visitor* is pleased to acknowledge its indebtedness to him for valued favors and cheering words.

L. A. REED, 75 Woodland Court, *Cleveland, Ohio*, was born at Vernon, May 7, 1860. He lived with his parents on a farm till 1877, when he entered Hiram College. For three years he attended the fall and spring terms of that college and taught during the winter, rendering entire satisfaction. Resumed his studies in college in 1881, and graduated with honor at Hiram College in 1883. After teaching the village school at Lordstown, he was engaged as civil engineer on the Connotton Valley and Ohio R. R. until this year, when he accepted the position of Stenographer and Bookkeeper for the Standard Lighting Co., Cleveland, having entire charge of the books for that firm. His work is neat, accurate, and gives evidence of a cultivated mind.

A. M. SCRIPTURE, *Clinton, N. Y.*, is another lover of mathematical investigation. Though he quit school at 17 and was a hard-working person (carpenter) yet by close application he qualified himself to pass the most rigid teacher's examination, and taught about 12 terms in the public schools. By taking periodicals devoted to mathematics, he rose to distinction in that line, and is doing quite a lively business in surveying. He writes out his work in good style and is an excellent calculator. He has sent us subscribers for several years and we appreciate the interest he takes in behalf of our magazine.

GEORGE CLIFFORD RUSSELL, born in Trumbull Co., Ohio, March 14, 1853, is a graduate from Hiram College June 8, 1882. Prior to this he worked on the A. & P. R. R., at the carpenter trade, and taught in the winter when not at college which he first entered in the Centennial year. While at Hiram none in his class were better in mathematics except L. A. Reed and E. S. Reed. Prof. Bancroft says, "He took a very high rank in mathematics." Pres. Hinsdale said that "he was a hard-working and successful student excelling especially in mathematical studies." June 15, 1882, he was married to Ella A. Beeman, daughter of O. K. Beeman, Southington, Ohio, the two were made one contrary to all rules of mathematics. He has filled the position of professor of mathematics in Grand River Institute, Austinburg, Ohio, and in the Hesperian College, Woodland, Cal.; and was Prin. of Greensburg (Ohio) High School one year. His address is now *San Francisco, Cal.*

WM. WILEY, 86 Jefferson Ave., *Detroit, Mich.*, was born in Boston, March 31, 1813 and reared there, being one of thirteen children. His schooling ended in the English high school at 15. He was very fond of problems in algebra, geometry, and trigonometry. From 1825 to 1833 he was in a wholesale dry

goods store in Boston. Then he went to New Orleans, to Quincy, Ill., and to Boston again in 1834, where he practiced surveying and civil engineering till 1843. At this time he became connected with the running of railways till 1852, being superintendent of the Auburn & Rochester R. R. from 1846 to 1849. Till 1860 he was connected with some transportation companies in Detroit, Buffalo, and Milwaukee, and since a book-keeper in a mercantile house of Detroit. He invented in 1869 a method of forming repetends by multiplication backwards, at a period of ill health from 1865 to 1873, as a sort of arithmetical gymnastics. He peruses with great pleasure not only the mathematics in our *Visitor*, but the other departments also. He has our thanks for his valuable contributions.

A. L. FOOTE, *Hempstead, N. Y.*, was born in Scotland, June 16, 1825, and came to this country with his parents in 1828. He helped his father on the farm and attended district school till he was 15, during which time he was inclined to innocent mischief. But an event occurred near the close of his school life, that awakened in him a plausible continuity. His teacher offered a prize to the pupil who would solve *all* of a set of examples in Arithmetic. Our hero solved all but one and was thus deprived of the coveted prize; but about a month later he succeeded one day at school in solving the *ox problem*, and in the joy of his heart he sprang to the floor like the ancient Greek with Hiero's crown, exclaiming, "I have it!" When order was restored the teacher examined his work and pronounced it correct. Mr. Foote attributes his success in solving difficult problems to the lasting impetus drawn from this little circumstance. He then spent six years on the sea, and during leisure hours successfully studied *Bonycastle's Algebra*, *Playfair's Euclid*, *Hutton's Mathematics* and *Vince's Fluxions*, all without a teacher. A sea-faring life was not satisfactory to himself and parents, so he returned home and commenced teaching at 23 years, and followed that vocation ever since, except three years as bookkeeper in New York City. Mr. Foote was married at 24. Shortly after this his parents sold their Long-Island home and moved to Harmony, Ind., where they soon died. His contributions to the *Visitor* are highly prized for their neatness, accuracy and conciseness.

HUDSON A. WOOD, now Prof. of Physics in the Case School of Applied Science at Cleveland, Ohio, was born in Smyrna, N. Y., May 10, 1841. He has a very interesting history, but our space permits us to give a few events. He was brought up on a farm, and at the age of twenty had taught two winters and completed the Freshman year in Madison University at Hamilton, N. Y., but 7 miles from his home. In 1861 he enlisted in the army, served two years, and was engaged in six heavy battles. In the battle of Fair Oaks he stood within a few feet of Gen. O. Howard, when he (Howard) was wounded in the arm which had to be amputated. In the battle of Frazier's Farm, a ball went through Mr. Wood's clothes, another through his knapsack, and besides he received two flesh wounds. After the battle of Malvern Hill, he was so severely injured while working on the fortifications, that he lay in the hospital five months and not getting better, was discharged from the army. Six months after his return from the army, he entered the Sophomore class in the Literary department of Michigan University where he graduated in '66. In college he spent more time with Latin and Greek than Mathematics, because they were more difficult for him to acquire. He was married to Mary Hicks, near Rochester, Sept. 2, 1868, and has two bright boys nine and eleven years of age. On graduation he received the title A. B. and since A. M. After graduation he was Principal of a school below Philadelphia for eight years, then Vice Prin. and Prof. of Higher Mathematics and Astronomy for several years in the Keystone State Normal School of Pa. For the past six years he was Prof. of Math. and Physics in the Collegiate Dep't of the New York School of Languages. During this time he wrote for several mathematical journals, and the pages of the *Visitor* have been enriched by his valuable contributions. He also did considerable work in the line of short hand at this time. Ohio feels proud to have

Prof. Wood in her educational field, and in the new institution lately endowed by Mr. Case in the sum of \$1,250,000, and with an apparatus worth \$15,000, our learned friend has just entered upon his work, being employed only two hours with his classes. It is the aim of the founders to make this the great scientific school of the West. Cleveland donated 23 acres in the suburbs, and the main building already occupied is a model of its kind.

JOSIAH HAYDEN DRUMMOND was born at Winslow, Me., Aug. 30, 1827. reared on a farm where his father and himself were born, and at a later day one of his children, and is indebted for a vigorous constitution to farm life in his youth. His aptness in figures while quite young caused much astonishment, and at the age of twelve he had finished the arithmetics then in use. In 1839 he spent 8 weeks at an Academy where he studied Algebra and Latin. In 1842 he was admitted to Waterville College now Colby University where he excelled in the higher mathematics, and completed the course in 1846. In 1845 he was temporarily appointed as Prin. of an Academy, to fill a vacancy, but succeeding beyond expectation, the trustees induced him to serve six months. He kept up his college studies and returned to go with his class. After graduation he was principal of an academy until 1848, when he commenced the study of law, and in connection with it, went through *Young's Integral Calculus*, for relaxation and amusement. After being admitted to practice in 1850, he took a trip to California, then only *via* Panama, and returned next year to take charge of the office in which he studied law, his preceptors retiring. He pursued his profession at Waterville till 1860 when he moved to Portland, Me., where he has since resided, closely engaged in professional business. He has never found the anxiety and strain caused by any case to be so great that he could not relieve himself by mathematical investigations, although they have often driven "sleep from his eyes and slumber from his eyelids." He rarely travels without having some mathematics with him, and he has written out most of his solutions to the *Visitor* under such circumstances. The degrees of A. M. and L. L. D. have been worthily bestowed upon him. In 1856 he was nominated without his knowledge, and in due time elected as representative to the state Legislature, and took an active part in the famous railroad contest in the Legislature. Next term he was re-elected and made Speaker of the House. In 1860 he became a member of the state Senate, and soon after on the death of the Attorney General he was elected by the Legislature to fill the vacancy. This office he held by re-election for three years, receiving even the support of political opponents. In 1869 he consented to be elected to the House of Representatives, of which he was at once made Speaker. He was married Dec. 10, 1850 and has four children. His only son, (Josiah jr.) is partner with him in the law firm of Drummond & Drummond. Our honorable friend made this statement in his masterly address to the students of his Alma Mater: "Whatever of success I may have attained in my profession, I attribute very largely to the habits and power of analysis which I acquired by the study of mathematics.

Problems for Solution.

825. If a solid globe of glass one foot in diameter be blown into a hollow sphere $\frac{1}{8}$ of an inch in thickness, what will be its diameter? SUBSCRIBER.

826. Suppose the market value of 5% bank stock to be $11\frac{1}{2}\%$ higher than 8% corporation bonds. I realize 8% on my investment and my income from each is \$180; what did I invest in each? AABON MOUL.

827. It is frequently remarked as very singular that those 8 months of the year which contain an r should all occur in sequence. How singular is it computed by the rule of combinations? WM. WILEY.

828. Dudley bought 5% railroad stock at $109\frac{1}{2}\%$ and $4\frac{1}{2}\%$ pike stock at $107\frac{1}{2}\%$, brokerage $\frac{1}{2}\%$; the former cost him \$100 less than the latter, but yielded the same income. What did each cost him? C. R. GEORGE.

829. How many tucks $\frac{3}{4}$ of an inch in width can a lady make in a strip of muslin one yard wide, leaving $\frac{1}{4}$ of an inch between the edge of one tuck and the stitching of the next? S. S. MILLER.

830. I sold two buggies for the same sum; on one I gained 30% and on the other I lost 50%. What did each cost me, if my loss was \$24 in the sale? GEO. M. MORRIS.

831. Two ladders stand on a plane with their bases 20 feet apart and their tops forming an angle of 45° where they touch. Find the length of each ladder. GUSTA LOOMIS.

832. A sphere and a cube have a common center. If the edge of cube is 5 inches and the diameter of sphere 7 inches, what is the volume of the cube within the sphere? EDITOR.

833. A square and its circumscribing circle revolve about the diagonal of the square as an axis. Find the volumes and surfaces thus generated by the square and circle respectively. ID.

834. A circle within another touches it at a point A, and the lune thus formed is 3 times the small circle. Now, how many revolutions will the smaller circle make if rolled on the circumference until it reaches again the original position on the point A. JAS. SMITH.

835. A door weighing 30 lb. is 8 feet long and 4 feet wide, and supported by two hinges with centers one foot from the top and bottom, respectively. Find the vertical and horizontal pressure on each hinge. ID.

836. What rate per cent of income shall I receive, if I buy U. S. 5's at a premium of 10% and receive payment at par in 15 years? ROBINSON.

837. A tumbler in the form of a conic frustum, is 4 inches in diameter at the top, 3 inches at the bottom, and 4 inches deep. A metal ball $3\frac{1}{2}$ inches in diameter is placed in the tumbler which was full of water. What per cent of the water will overflow? N. B. WEBSTER.

838. A and B start from a town at the same time for the same point; it takes A 10 hours to reach the point, and B travels 5 times as fast going, and 10 times as fast returning, as A; when and how far from the town do they meet? D. W. K. MARTIN.

839. What are the sides of an equilateral spherical triangle whose area is $\frac{1}{2}$ surface of sphere? WM. WILEY.

840. The side of a square is 100 feet. What is a side and area of its inscribed equilateral triangle? H. A. WOOD.

841. "What two whole numbers are those, the sum of whose squares multiplied by the greater is equal to 1305, and the difference of whose squares multiplied by their product is equal to 1224." MARCELLUS M. THOMPSON.

842. A well 3 ft. in diameter is under a horizontal roof 10 ft. high. What is the length of the longest pump-stalk that can be inserted? B. F. FINKEL.

843. A ladder stands plumb against a perpendicular wall. The ladder is 10 ft. in length and the rungs are one foot apart. A person starts to climb the ladder, but for each foot he ascends the bottom of the ladder slides one foot from the wall; so that when the top of the ladder is reached, the ladder is on the ground at right angles to the wall. Required the distance through which the person travels and the curve. L. A. REED.

844. An anchor ring made of 3 inch round iron, has for its diameters 18 and 24 inches, interior and exterior. Find the volume of a segment of this ring made by a plane passing $\frac{1}{4}$ in. from the center of the rim and parallel to the plane of the ring. HENRY GUNDEL.

Solutions should be received on or before Jan. 8, 1886.

ERRATA.—In this issue, page 231, first line, insert =may for 2d member of equation (1). In Nov. No., p. 211, last line, fraction should be $\frac{16^9}{300}$ and answer \$.314.

ENGLISH GRAMMAR.

Answers to Queries.

1. Parse—Since my return here, the fear of *being surprised* has made him *accustomed to come* early; he *used to come* late. A. B.

ANS.—*Being surprised* is a present participle, passive form, and has the construction of a noun; it is the object of the preposition *of*. *Accustomed* is an adjective, the attributive object of *made*, and belongs to *him*. *To come* is an irregular intransitive verb; it is in the infinitive mode, present tense, has the construction of an adverb in both cases; the first modifies *accustomed* and the second the intransitive verb *used*.

2. State the difference between—"What shall you do to-morrow," and "What will you do to-morrow." Id.

ANS.—We think the former implies duty or obligation and the latter fatuity only.

3. Parse italicized words in the following: B. F. F.

For *standing* on the Persian's grave

I could not *deem myself* a slave.

Heaven forgive that thought! the while

Which made me *both* to weep and smile.

All that most endears

Glory, is *when* the myrtle wreathes a sword

Such as Harmodius drew on Athen's tyrant lord.

ANS.—*Standing* is a present participle and belongs to *I*.

Could deem is a regular, transitive verb, in the potential mode, past tense, and agrees with its subject *I* in the first person and singular number.

Myself is a compound personal pronoun: masculine gender, third person, singular number, objective case; it is the object of *could deem*.

Slave is a common noun, having the same properties as *myself*, and is the attributive object of *could deem*.

Heaven (*God*) is a proper noun; masculine gender, third person, singular number, nominative case; it is the subject of *forgive*.

Forgive is an irregular transitive verb, in the imperative mode, third person, singular number, to agree with *Heaven*.

Both-and are correlative conjunctions, *both* introducing and *and* connecting the two infinitives.

All is a common noun; neuter gender, third person, singular number, nominative case; subject of *is*.

When is a conjunctive adverb; it connects what follows to *is* and modifies *wreaths*.

Such is an adjective, limiting *sword* understood.

As is a relative pronoun; it has *sword* understood for its antecedent with which it agrees in the neuter gender, third person, singular, and it is in the objective case, object of *drew*.

Drew is an irregular transitive verb; indicative mode, past tense, third person and singular number, to agree with *Harmodius*.

4. Parse and analyze difficulties in—"He were no lion, were not Romans hinds." S. L.

ANS.—*Lion* is in the predicate with *were*; second *were* is in the subjunctive mode, and the clause *if Romans were not hinds* is a modifier of *were*. *Romans* is the subject of *were*, and *hinds* in the predicate. See Eubank's Key to Harvey.

Answers to Correspondents.

ZEALOUS, Kansas City.—Since there are 21 men over when the general forms his men into a solid square, and 200 men lacking when he attempts to add one man to each side of square, the difference between the number of men in the squares filled would be $200 + 21 = 221$. Adding one row of men to each of two sides of the first square, leaves a corner requiring one man to complete the new square; hence $221 - 1 = 220$ men in the two rows, or 110 were on each side of first square, and he had $110^2 + 21 = 12121$ men. (See Vol. 6, No. 5, p. 77).

L. S. H.—The best advice we can give you is embodied in the following outline of the laws which underlie all good teaching.

1. The teacher must know thoroughly and familiarly the lesson or truth to be taught, and come before his class with a live enthusiasm kindled by a full mind and a clear understanding.

2. A learner is one who attends with interest to the lesson given. Refuse to instruct until the pupil is ready to give attention.

3. Use vivid and clear language which is understood by teacher and pupil in the same sense. forcible and discreet expression is the teacher's strongest power.

4. The lesson must begin with what is already known by the pupil, then proceed to the unknown in single, easy and natural steps, which is the inductive method.

5. Teaching is *arousing* and *using* the pupils mind to form in it a desired conception or thought, and leading him to think out the truth himself.

6. Learning is *thinking* into one's own *understanding* a new idea or truth. You should require the pupil to think out his lesson in parts and to express the whole in his own language.

7. The finishing and riveting process must be in a *re-viewing*, *re-thinking*, *re-knowing* and *re-producing* of the knowledge acquired, and deepening the impressions with new thoughts, correcting false views, and completing the true.

COUNTRY TEACHER.—Our space at this time is too limited to answer fully your question relative to the country school. We agree with you that the discussion at Versailles on this subject was not to the point. The country teachers should have been called upon to discuss the question, but we have noticed that they do not get a chance to say much in the association, and perhaps they have no disposition to do so. The insinuations about the illiteracy of the country pupil and the "sick" condition of those who manage his educational interests, were inappropriate and uncalled for. We have found that the country pupil is often more thorough in what he does than the village pupil, and the earnest, hard-working teacher in the rural district deserves far more credit for his arduous labors than he seems to get. But that was all out of order. The great problem was untouched—How should the country school be organized and managed so as to lessen the unnecessary labors of the teacher and to increase the facilities by which the country pupil may obtain at home a complete common school education? He might have algebra, practical book-keeping, natural philosophy, rhetoric, civil government, etc., in addition to the studies he generally pursues. Talks on chemistry, botany, and astronomy would be profitable. To have all this requires money and well-qualified teachers, which the village and city schools usually secure. If the young teacher is employed in the village, he has the wise counsel of experienced superintendent to direct his work, and uniformity of methods, text-books, and studies, in connection with better classification. If the readers used in the country school consisted of four books instead of six, it would be a great advantage. In our course of study in the country thirty years ago, we passed from the spelling book into the *English Reader*, and finished with *Porter's Rhetorical Reader*. We repeat, that too much time is lost in many schools by hearing five or six reading classes three or four times a day. One lesson a day well prepared and properly recited, in which the pupil is led to grasp the thought and realize the beauty of expression in its rendition, is infinitely more valuable than four lessons in calling words.

Examination Questions.

The lists of the Darke County board of examiners will be regularly presented in the *Visitor* for 1886, with carefully prepared answers. This will be of special interest to home subscribers.

GEOGRAPHY.

1. What two European countries have the largest territorial possessions in the world?

Ans.—England and Russia.

2. Name the largest city in each of the following countries: England, France, Germany, North America, China.

Ans.—London, 4,764,312. Paris, 2,225,000. Berlin, 1,122,385. New York, 1,206,204. * Pekin, 2,000,000.

3. What is the most important ocean current? In what does its importance consist?

Ans.—The Gulf Stream, because its waters heat the trade winds, which, blowing over western Europe, temper its climate and render the waters along the northern coast of Europe navigable through out the year.

4. In what part of the U. S. is mining largely carried on? Why?

Ans.—In the western and the eastern, because these sections have imbedded beneath the surface the richest deposits.

5. What are continental islands? What other class of islands is there?

Ans.—Continental islands are generally elongated in shape and parallel to the coasts near which they lie. In structure they are like the neighboring continents. Oceanic islands are of volcanic or limestone origin, and are at a considerable distance from the main land.

6. What empire on the western continent? What important republic on the eastern?

Ans.—Brazil. France.

7. What country in Europe contains the largest population in proportion to its area?

Ans.—Belgium. Density of population is 468 to the square mile. Great Britain only 289.

8. What three lakes form Michigan into two peninsulas?

Ans.—Superior, Michigan and Huron.

9. When it is summer at New York, what season is it at Rio Janeiro? Why?

Ans.—Winter; because the sun's rays are then most oblique in the southern hemisphere.

10. Why are icebergs in the Antarctic ocean a proof of the existence of land in the southern part of that ocean?

Ans.—Because icebergs are broken masses of ice from glaciers which are formed on land surfaces generally.

HISTORY.

1. Who are the Mormons?

Ans.—A religious sect founded by Joseph Smith, at Manchester, New York, in 1830. Smith alleged that on the night of Sept. 21, 1823, the angel Moroni appeared to him thrice, and told him that the Bible of the Western Continent,

the supplement to the New Testament, was buried in a certain spot near Manchester, and, four years later, that he received from the angel a stone box, in which was a volume, 6 in. thick, made of gold plates 8×7, and fastened by three gold rings. That the plates contained writing in the "reformed Egyptian" tongue, accompanied by supernatural spectacles, consisting of two crystals set in a silver bow, and called "Urim and Thummin."

2. What was the effect of the discovery of gold in California in 1848?

Ans.—It excited the whole country, and thousands were pouring toward California.

3. Name the two principal discoveries of Columbus.

Ans.—West Indies and South America.

4. What were two notable events in Monroe's administration?

Ans.—Missouri Compromise and the official announcement of the famous *Monroe Doctrine*. See Oct. Visitor, p. 189.

5. Where, when, and by whom was the first settlement made on the grant to the Plymouth Company? The London Company?

Ans.—(1) At Plymouth, Dec. 21, 1620, by the Pilgrims. (2) At Jamestown, May 13, 1607, by a colony of 105 persons under Christopher Newport.

6. State five causes of the American Revolution.

Ans. Taxation without representation; Stamp Act; Boston Port Bill; Spirit of freedom among colonists; influence of France.

7. Who discovered the Mississippi river? Florida? St. Lawrence river? Pacific Ocean? Ohio river?

Ans.—De Soto. Ponce de Leon. Jacques Cartier. Balboa. La Salle.

8. In what way was Georgia settled?

Ans. By James Oglethorpe and twenty other trustees, under a charter to run 21 years. The object of the colony was to provide a place for poor and worthy debtors in English prisons. The colony was founded Feb. 12, 1733, at Savannah; by Oglethorpe and thirty-five families.

9. What made the United States Constitution of 1789 a necessity?

Ans.—The course of events.

10. Name five treaties included in American history.

Ans.—The first treaty was made between the Dutch and Indians, Aug. 30, 1645, bringing a cruel war to a close.

Treaty of Utrecht, April 11, 1713, closing Queen Anne's War.

Wayne's Treaty with the Indians, at Greenville, Ohio, August 3, 1795, closing the Indian War, and opening the great North-West Territory to the incoming settlers.

Treaty of Peace, signed at Ghent, Dec. 24, 1814, and reaching America, Feb. 11, 1815, closing War of 1812.

Treaty of Hidalgo, declaring peace between the United States and Mexico, was signed at Guadalupe Hidalgo, Feb. 2, 1848. This town now known as Guadalupe (the *Hidalgo* is dropped) is about 3 miles north of the city of Mexico.

Treaty of Washington, closed May 8, 1871, whereby the claims of United States and Great Britain against each other were to be settled by four boards of arbitration; 1, Alabama claims, at Geneva; 2, General claims at Washington; 3, San Juan boundary to the decision of the German emperor; 4, Coast fishery question, to a tribunal to sit at Halifax.

11. What historic events occurred in November, 1885.

The death of Hon. Thos. A. Hendricks, Vice President of the United States, at his residence in Indianapolis, Nov. 25. The Galveston fire Nov. 13; total loss, \$1,000,000.

GRAMMAR.

1. Define conjugation, inflection, agreement, government, and enallage.

Ans.—*Conjugation* is the regular arrangement of the properties of the verb. *Inflection*, see p. 212. *Agreement* has reference to similarity of words in their properties. *Government* is the power one word has over another to cause it to assume some particular modification. *Enallage* is a figure of syntax and is the use of one part of speech or of one modification for another.

2. Name the tenses of each mode.

3. Name the signs of the tenses of the indicative and potential modes.

4. Describe the difference between person and number of verbs and number of verbs and person and number of nouns.

Ans.—Person as applied to nouns has reference to the different relations which the objects mentioned bear to the discourse; but to verbs they are applied by inference from the principles of agreement only.

5. How are sentences divided with respect to use?

Ans.—Declarative, exclamatory, interrogative, and imperative.

6. How are sentences divided with respect to form? Illustrate by examples.

Ans.—Simple, complex and compound.

7. How determine when *as*, *what*, and *that* are used as relative pronouns?

Ans.—By reference to antecedents and by their use.

8. Write a sentence containing a noun in apposition with another noun. How is the case of nouns in apposition determined?

Ans.—Smith the lawyer said he was guilty. By the case of the noun explained.

9. State the difference between a participial adjective and an adjective used as a participle.

Ans.—Participial adjective does not possess the distinctive properties of a verb or participle, and can not have an object, which is the only difference.

10. Indeed, I have often thought that modern science had offered a most opportune and providential safety valve for the intellectual curiosity and ambition of man, at a moment when the progress of education, invention, and liberty had roused and stimulated him to such unprecedented eagerness and ardor.—Analyze.

Ans.—*Thought* is modified by all that follows as an adverbial element. *Had* offered by *valve* (object), for *curiosity* and *ambition* and at *moment*. *Moment* is modified by all that follows (adj. element). *When* (=in which) is an adverb, modifying *had roused* and *stimulated*, which are also modified by *him* and to *eagerness* and *ardor*. *Index* is an independent adverb.

SPELLING.

Supercedure, mucilage, guerrilla, pensile, steppe, serf, grisly, analyze, adventitious, bouquet, diphtheria, conscientious, Suwanee, cylinder, meerschaum, percussion, periphery, pernicious, elision, rheumatic.

ARITHMETIC.

1. $\frac{2}{4}$ of $(2\frac{1}{2} \div \frac{2}{3}) + \frac{3}{5}$ of $\frac{1}{3}$ of $\frac{5}{6}$ = what?

Ans.—We have $\frac{4}{6} + \frac{1}{6} = 2\frac{4}{6}$.

2. If $\frac{7}{9}$ A. of land cost \$20 what will $1\frac{5}{8}$ cost?

Ans.—One acre cost $20 \div \frac{7}{9} = \$25\frac{5}{7}$, and $1\frac{5}{8}$ acres will cost $25\frac{5}{7} \times 1\frac{5}{8} = \$47\frac{1}{8}$.

3. What principal will in 2 yr. 7 mo. and 12 da. at 6% amount to \$563.51.

Ans.—The amount of \$1, for the given time and rate, is \$1.157; $\therefore 563.57 \div 1.157 = \487.006 .

4. Agreed to pay \$5 a cord for wood; it was to be cut 4 feet long; but was only $3\frac{3}{4}$ feet long. How much, in justice, should be deducted from the contract price?

Ans.—He should pay $\frac{1}{4}$ of $3\frac{3}{4}$, or $\frac{1}{16}$ of \$5; hence $\frac{1}{16}$ of \$5 = \$.31 $\frac{1}{4}$ should be deducted.

5. A pole 82 feet long is standing in water; $\frac{3}{4}$ of the length above the water is equal to $\frac{2}{3}$ of the length under water? How many feet under water?

Ans.—The length above water is $\frac{5}{4} \div \frac{2}{3} = \frac{15}{8}$ of the length under water; hence 82 must be divided in proportion of 20 to 21, and we have 40 feet above water and 42 feet under water.

6. A party of 10 hire a boat. If there had been 2 more the expense of each would have been reduced \$1 $\frac{1}{2}$ each each. How much was paid for the boat?

Ans.—Each of the 12 paid \$1 $\frac{1}{2}$ less than each of the 10 men; hence the two would have paid $12 \times 1\frac{1}{2} = \18 and one man's share of expense was $\$18 \div 2 = \9 . The boat cost $10 \times 9 = \$90$.

7. Find the solid contents of a cone whose base is 15 feet in diameter and whose perpendicular height is 21 feet.

Ans.—Area of base is $15^2 \times .7854 = 176.717$ sq. ft.; multiplying by $\frac{1}{3}$ the altitude, we have $176.717 \times 7 = 1237.019$ cu. ft.

8. A, B, C do a piece of work in a certain time. A and B together do $\frac{5}{9}$ of it; B and C together do $\frac{2}{3}$ of it. What part can B do alone?

Ans.—C does $\frac{5}{9} - \frac{2}{3} = \frac{1}{9}$ of it; and B $\frac{2}{3} - \frac{1}{9} = \frac{5}{9}$ of it.

9. A owns a square field which contains as many acres as there are rods around it. How many acres in the field?

Ans.—Since four sides are fenced, each strip across the field one rod wide must contain 4 acres or $4 \times 160 = 640$ sq. rds.; hence the side of the field is 640 rds. and contains $640^2 \div 160 = 2560$ acres. Or by the conditions we have

$$\frac{1}{160}(\text{side} \times \text{side}) = 4 \times \text{side}.$$

Multiplying both sides of the equation by 160 we have $\text{side} \times \text{side} = 640 \times \text{side}$, or $\text{side} = 640$ as before.

10. The Continental insured $\frac{2}{3}$ of A's Machine shop at 3%. The Phoenix relieves them of $\frac{1}{3}$ the risk at 2%, and the Teutonia of $\frac{1}{3}$ of it at 1 $\frac{1}{2}$ %. By fire the Phoenix lost \$3250 more than the Teutonia. What was A's rate of loss on value of shop?

Let 100% = value of shop; then 66 $\frac{2}{3}$ % = whole risk, and the entire premium is 3% of 66 $\frac{2}{3}$ % = 2% of value of shop. Phenix gets 2% of 33 $\frac{1}{3}$ % = $\frac{2}{3}$ %, and Teutonia 1 $\frac{1}{2}$ % of 16 $\frac{2}{3}$ % = $\frac{1}{2}$ %, on value of shop. Phenix loses 33 $\frac{1}{3}$ % - $\frac{2}{3}$ % = 32 $\frac{1}{3}$ %, and Teutonia loses 16 $\frac{2}{3}$ % - $\frac{1}{2}$ % = 16 $\frac{1}{6}$ %; hence 32 $\frac{1}{3}$ % - 16 $\frac{1}{6}$ % = 16 $\frac{1}{6}$ % = \$3250, and $\$3250 \times 100 \div 16\frac{1}{6} = \$20,000$ is the value of the shop. A loses ($\frac{1}{3}$ of \$20,000) + (2% of \$2,000) = \$7066 $\frac{2}{3}$ and $7066\frac{2}{3} \times 100 \div 20000 = 35\frac{1}{3}$ % is the required rate.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

NOTE.—Gen. John Stark did not say upon entering the Battle of Bennington, "Boys, we hold that field to-night or Mollie Stark's a widow." His wife's name was Elizabeth, the daughter of Caleb Mills, of New Hampshire. He said *Betsey* instead of Mollie. In Rodman's poem on the "Battle of Bennington, we find the following stanza:

The morning came—there stood the foe;
 Stark eyed them as they stood;
 Few words he spoke, 'twas not a time
 For moralizing mood.
 "See there, the enemy, my boys;
 Now, strong in valor's might,
 Beat them, or Betty Stark will sleep
 In widowhood to-night."

This is given in answer to several queries from correspondents.

745. Locate and describe the Hoosic Tunnel.

R.

ANS.—Hoosac Tunnel is on the railway from Boston to Troy, and is $4\frac{3}{4}$ mi. long, reaching through the Hoosac Mts. Work was first begun in 1851, but soon abandoned. It was again resumed in 1862 and the final blast was made Nov. 27, 1873. It was not completed till 1876. The work of excavation was mostly done by drills, operated by pneumatic power and resembling those employed in Mt. Ceniz. A working shaft 1028 feet deep near the center was left open to aid in ventilation.

LUCY VOGT.

747. How and whence came the bowlders in Ohio?

D.

The term *drift* is employed to designate the immense deposits of sand, gravel, clay and bowlders, or loose rocks on the American continent. The origin of this material is referred to a "Glacial Period", when from some cause a change of climate caused immense masses of ice, either in the form of icebergs or glaciers, to plow their way over the continent, bringing the material from the Archaean beds and depositing it over the existing formations, and at the same time scoring and grooving the underlying rocks.—*Teachers and Students Library.*

J. H. W. SCHMIDT.

748. Give a sketch of the animal of Pliocene times not yet extinct.

ANS.—Fossils from the Pliocene beds prove the existence of the Camel, the Rhinoceros, the Elephant, the Mastodon, the Horse, the Deer, the Wolf, the Fox, the Tiger, and the earliest of the Bovine or Ox.

M. W. HOLLINGER.

749. Describe the serpent mound of Adams Co., Ohio.

D.

ANS.—The most extensive and remarkable *Effigy Mound* in Ohio is situated near Brush Creek, in Adams county. It is in the form of a serpent of more than a thousand feet in length, his body forming graceful curves, and his tail terminating in triple coils. The embankment which constitutes the main body of the serpent is about five feet in height, measures thirty feet in width, and diminishes in size both towards the head and tail. The neck of the figure is stretched out, and slightly curved, and the mouth is opened wide, as if in the act of swallowing or ejecting an oval figure, which rests partly within the distended jaws. This oval figure is formed by an embankment four feet high, and is perfectly regular in outline, its transverse and conjugate diameters being one hundred and three, and thirty-nine feet, respectively. The combined figure has been regarded by some as a representation of the oriental cosmological idea of the serpent and the egg.

J. H. W. SCHMIDT.

750. Who was the "Lost Child of America?"

S.

Ans.—Charles Ross, son of Christian K. Ross, of Germantown, Pa. The story of his abduction has been read by many people.

GEO. L. SHANER.

751. Who is the author of "The Battle Cry of Freedom"?

S.

Ans.—It is said that Geo. F. Root, a musical professor, editor and publisher of Chicago wrote it. He was born in Mass, 1820.

EDITOR.

752. Give a short history of Charles Mackay.

F.

Ans.—Charles Mackay, editor of the "Glasgow Argus" 1844-47, and editorially connected with the "London Illustrated News", and other papers; was war correspondent in United States during the civil war, but is best known by his songs and lyrics. Born in Scotland in 1812.

B. F. FINKEL.

753. What is meant by the "South-Sea Bubble"?

F.

Ans.—The "South Sea Bubble" is a name popularly applied to a stupendous stock-jobbing scheme, in England, in 1720, characterized as "the most enormous fabric of national delusion ever raised among an industrious and prudent people." The South Sea Company, a trading corporation, having exclusive privileges, offered to buy up government annuities, with a view to the reduction of the public debt. The proposal was accepted, great numbers of people hastened to invest in the stock of the company, which rose to an extraordinary premium, when, on the 29th of September, this greatest of bubbles burst. Merchants, lawyers, clergymen and physicians passed from their dreams of fabulous wealth, and from their wonted comforts, to penury. "Some died of broken hearts, while others removed to remote parts of the world, and never returned."

JNO. H. KNIESLY.

754. In whose memory was the following written?

F.

Here lies she who never lied;
Whose skill often has been tried;
Her prophesies shall still survive,
And ever keep her name alive.

Ans.—Mother Shipton. It is supposed that she was born during the reign of Henry VII., and sold her soul to the devil for the power of foretelling future events.

JOHN FITZGERALD.

755. When did France have a crazy king?

W.

Ans.—Charles VI. was riding through a deep forest on a sultry day in August, when a tall and ghastly man rushed suddenly out from behind a tree, seized the King's bridle, and exclaimed, in a terrible voice: "Go no further, O King! Thou art betrayed!" Charles, weak from recent illness, was greatly agitated. Soon after, while upon a sandy plain the vertical rays of the sun were pouring upon them, one of his attendants falling asleep, accidentally dropped his lance upon his companion's helmet. The brain of the King was startled out of reason, and rushing on his attendants, he sought to slay them all. He was at last secured and carried back—a maniac. For thirty years France affords the picture of a madman sitting on the throne. Charles partially recovered but afterwards suffered a serious relapse.

H. A. Wood.

760. When have fish been known to fall with a shower of rain?

Ans.—The Carnarvon *Herald*, 1833, says: In that year at Lake Gwynant, in the county of Carnarvon, a woman saw a shower of small fishes fall partly into the lake, and partly upon the land close to where she was. The fish resembled herrings, but were much smaller.

A Louisville Newspaper, Nov., 1835, contains an account of a shower which had just fallen, after which a number of small fish were found in the gutters in Jefferson Street. They were said to be from two to three inches long, and mostly sun-perch.

In a note by Yarrell in Reid's *Law of Storms* we find the following: On the 9th of March, 1830, the inhabitants of the island of Isla, Argyleshire, after a day of heavy rain, were surprised to find numbers of small herrings strewn over their fields, perfectly fresh, and some of them exhibiting signs of life. Similar instances of showers of small fish are well authenticated.

Hasted, in his *History of Kent*, also states that in 1666, about Easter, after a great tempest of thunder, hail, and wind, in a pasture field in the parish of Stansted, about a bushel of fish were gathered. This field was at a considerable distance from the sea or any branch of it, and a place where there were no fish-ponds.

H. A. Wood.

761. Describe the Sea Cucumbers. Tell where they are found.

Ans.—Sea Cucumbers (Holothuroidea) are singular, elongated or cylindroidal animals, closely allied to *sea urchins*, but without either spines or hard test. They are found among tangles or in moderately deep water along the western shores of Europe. The body-wall is muscular, and contains in its surface layer calcareous spicules, resembling anchors, wheels, etc. The mouth is surrounded by plumose tentacles, and on the surface of the body are rows of tube feet. The intestine is of great length, and ends in a small aboral sac or cloaca, into which also open (in most species) two very remarkable tree-like organs which lie in the body cavity, and which are adjuncts to the water vascular system for purpose of breathing. In tropical seasons of these Holothurians are inhabited by little parasitic fishes, and even in temperate regions small shelled mollusks are found in or on their bodies as parasites. One species, the Trepang, is imported in large quantities from N. E. Australia into China, where it is regarded as a luxury of diet. This creature possesses the power of self mutilation. When in danger it ejects all its teeth, its stomach, its digestive apparatus, and even its body, and as soon as its danger is over it will begin to reconstruct its body. Dr. Johnson, who kept one of these animals in an aquarium, having neglected to feed it, found its internal apparatus thrown out and the animal itself an empty dilapidated tube.

M. W. HOLLINGER.

762. What king wrote an essay against the use of tobacco?

Ans.—King James, of England, saw that the use of tobacco, in thirty years, had become surprisingly common, and wrote his famous *Counterblast* against its use. In those days the *gentlemen* had silver pipes, and large sums were expended, some lavishing three or four hundred pounds per annum upon the "precious stinke", as his majesty stigmatized it. He styles it "a custom loathsome to the eye, hateful to the nose, harmful to the brain, dangerous to the lungs, and in the blacke stinking fume thereof nearest resembling the horrible stigmatic smooke of the pit that is bottomlesse." Notwithstanding the *counterblast* the consumption has increased until the total annual production is now estimated at 2,000,000 tons.

H. A. Wood.

763. We have seen somewhere the title "The Book-Fish. Explain.

Ans.—On the 23d of June, 1626, a cod-fish was sold at Cambridge market which, when opened, was found to contain a book. It was written by John Trith, while in prison, and contained treatises on religious subjects. Mr. Mead of Christ Church, Cambridge, wrote to Sir M. Stuteville, that he saw all with his own eyes, "the fish, the man, the piece of sail-cloth with which the book was covered, etc." This letter is said to be now in the British Museum. The fish came from Lynn. The book was reprinted by the authorities at Cambridge, under the title "Vox Piscis," with a woodcut representing the fish-stall, the hook, and the knife.

H. A. Wood.

765. Give a short sketch of the "Infernal Triumvirate." K.

Ans. The name given in Roman history to the private League entered into between Pompey, Crassus and Caesar, the three most powerful men of their time. The object of this was to carry out their own schemes of political aggrandizement in spite of the opposition of the Senate.

E. B. HESTAND.

766. Name all the cantons of Switzerland.

Ans.—Geneva, Vaud, Neuchâtel, Tribourgh, Bern, Basel, Aargau, Soleure, Lucerne, Unter-Walden, Zug, Schwytz, Zurich, Châfhouse, Thurgau, Appenzell, St. Gall, Glarus, Uri, Grisons Ticino, and Valais.

J. W. KECKLER.

767. Who was known as "The Protector of the Indians"?

Ans.—Las Casas (1474-1556) a native of Seville, Spain, and known to posterity as "The Apostle of the Indies," was appointed in 1516 by Cardinal Jimenez to go to San Domingo to reform abuses in the treatment of the oppressed natives, and in this work he received the title of "The Protector of the Indians." His father was one of the companions of Columbus in his first voyage, and he accompanied his father in 1498, in an expedition under Columbus to the West Indies.

EDITOR.

768. Give the author of the following:

"The unfinished window in Alladin's tower unfinished must remain."

Ans.—Longfellow said this in allusion to Aladdin's wonderful lamp, by the genius of which a palace was built containing twenty-four windows, all but one being set in frames of precious stones; the last was left for the sultan to finish; but after exhausting his treasures, the sultan was obliged to abandon the task as hopeless. Hence to *finish Aladdin's window*, means to attempt to complete something begun by a great genius, but left imperfect.

EDITOR.

769. Is the story of Tell and Gessler a myth? Explain. B.

Ans.—The ruthless hand of the modern investigator tears to pieces many of our popular beliefs, and the traditions of antiquity are shown by him to have no foundation in fact. Among the popular tales is that of Tell and Gessler, and one historian even proves that no such man as Gessler ever was governor in Switzerland.* Be that as it may, one thing is certain, as long as Switzerland remains a William Tell will be honored revered as one of its deliverers from the yoke of the oppressor.

J. H. H. SCHMIDT.

A work containing a series of documents relating to early Swiss history, published in 1835 by M. Kopp, of Lucerne, shows that, although a continuous series of charters exist relative to the bailiffs of Küssnacht in the 14th century, there is no Gessler among them.

ED. RYNEARSON.

760. Give all the allusions and applications of the term "Ring."

Ans.—The querist will please consult Webster's Dictionary. We add the following:

A *Ring* was given in Roman espousals by the man to the woman as a pledge, which she wore on the third finger of the left hand, because it was supposed that a nerve ran from that finger to the heart.

Pope Innocene's Rings. May 29, 1205, pope Innocent III. sent John, King of England, four gold rings set with precious stones, and thus explained the matter: The rotundity signifies *eternity*, remember we are passing through time into eternity. The number signifies the four cardinal virtues—*justice, fortitude, prudence and temperance*. The material *wisdom from on high*, which is as gold purified in the fire. The green emerald is an emblem of *faith*, the blue sapphire of *hope*, the red garnet of *charity*, and the bright topaz of *good works*.

EDITOR.

771. What pope changed his name on ascending the papal chair?

Ans.—It might more properly be asked, *What* pope did *not* change his name on ascending the papal throne? for as a rule *all* popes change their names on doing this. Take the popes of the 19 century:

Pius VII. (Gregoria Barnaba Chiaramonti),

Leo XII. (Annibale de la Genga),

Pius VIII. (Cardinal Castiglioni),

Gregory XVI. (Mauro Cappellari),

Pius IX. (Giovanni Maria Mastai-Gerretti,
Leo XIII. (Joachim Pecci)

Here we find that on the ascension to the papal chair *not one* kept the name that he had before the election to the papacy. J. H. W. SCHMIDT.

772. Give the legend of the Phoenix, and its applications.

Ans.—Phoenix is the name of a mythical Egyptian bird, supposed by some to be a kind of plover, like the *kibitz*, often depicted with human arms, and called in hieroglyphs *rekh*. Others consider it to be the *beniu*, or *nycticorax*, a bird sacred to Osiris, and represented watching in the tamarish over his coffin. The first of these representations has sometimes a star upon the head, supposed to indicate the astronomical period of its appearance. It visited Egypt after the death of its father, and entered the shrine particularly dedicated to it at Heliopolis, and there buried its parent, putting the body into an egg or case made of myrrh, and then closing up the egg. Another account is, that the Phoenix, when about to die, made a nest for itself in Arabia, from which a new Phoenix sprung of itself. This bird proceeded to Heliopolis, and there burned and buried its father. But the more popularly known version is, that the Phoenix burned itself, and a new and young Phoenix sprung from the ashes. It is used as an emblem of immortality and is the name of a constellation. J. H. W. SCHMIDT.

773. Give the natural history of the May-fly or June-bug. J.

Ans.—The scientific name of this insect is *Ephemera*, in allusion to its short life. It lives about 24 hours after it becomes a fly. Previous to this stage it has lived in the water for several years in its preparatory state. The eggs are dropped into the water by the female in large quantities, and in a few months the young larvæ are excluded. After passing through various stages, and reaching its full growth, the insect emerges from the water, the thorax splits down the back and the winged form appears. They appear in myriads in many parts of the world and are a great annoyance. The teachers of Ohio remember the insect of Association days at Lake Side, when it was sometimes inconvenient to sit down. Fish devour the insect speedily, and enjoy a veritable feast during the short period of its appearance. EDITOR.

774. Explain the meaning of "blue stocking, and give its origin.

Ans.—Blue Stocking—a literary woman. In 1400 a society of ladies and gentlemen was formed at Venice, distinguished by the color of their stockings and called *debla calza*. In Paris it made its appearance in 1590, when it became popular among the female *savantes*. It came into notice in England in 1780, and was kept up until 1840, up to the death of its last supporter, Miss Monckton, the Countess of Cork.—*Peoples Cyclopedia*. C. A. SEBRING.

Ans.—A name given to learned and literary ladies, who display their acquirements in a vain and pedantic manner to the neglect of womanly duties and graces. The name is derived from a literary society formed in London about the year 1780, which included both men and women. A gentleman by the name of *Stillingfleet*, who was in the habit of wearing blue stockings, was a distinguished member of this society. And hence the name was adopted both in Germany and France. J. W. NICHOLAS.

775. Give a sketch of the present popular Ameer of Afghanistan.

Ans.—He is a fine looking gentleman, and his name is Abdurrahman Khan. He is 45 years old. At 24 he began a contest with his uncle, Shere Ali, for the throne of Cabul. He fought in the interest of his father. The civil war lasted over six years and proved unsuccessful. In 1869 he was forced to fly for his life to Russian Turkestan, and was there protected by that government. When the English invaded Afghanistan and caused Shere Ali to fly, Abdurrahman's auspicious time came. In the Autumn of 1880, after his son Zakoob was deposed, the government was handed over to him. EDITOR.

776. Can you see your own shadow?

ANS.—At night in a humid atmosphere, you can distinguish the darkness before you, when a light is held at a distance in the rear, the space thus cut off from the light is your true shadow. Many persons take the figure that rests against an object or on the ground for the whole shadow, which is a mistake. This is merely the end of your shadow, and is the only portion visible in daylight.

EDITOR.

777. Of what benefit is lightning? What is a "cold stroke"?

ANS.—The air is vitalized by the rapid progress of free electricity through it, for it condenses the atmospheric vapor, and ozonizes the gases. A "cold stroke" is simply a light stroke in which the rapidity of the lightning is not sufficient to produce a great quantity of heat by friction.

GALEN.

778. Where in this country are mud baths administered?

ANS.—In New Mexico, near Las Vegas, it is said that invalids bathe in the mud springs, whose gelatinous substances are supposed to act as a poultice in believing patients of obstinate diseases.

GALEN.

779. Why are tides higher in the Red Sea than in Mediterranean?

ANS.—The height of the tide depends upon local circumstances. In the midst of the Pacific ocean it is scarcely two feet, which is considered its normal level. When dashing against the land or into deep gulfs, etc., they are much higher. The tidal wave of the Pacific coming through the Indian ocean, forces the water into the Red Sea, while the tides of the Mediterranean are retarded by the surrounding land.

J. H. W. SCHMIDT.

780. Did it ever "rain cats and dogs"?

ANS.—No. It is merely a perversion of the word *catadupe* (a waterfall). It is raining catadupes or cataracts.

LUCKY VOGT.

English sailors still say "The cat has a gale of wind in her tail," when the weather is rough, as Northern mythology supposed the cat to have great influence on the weather. The dog is a signal of *wind*, an attendant of the storm-god. In old German pictures the wind is represented as proceeding from the mouth of the dog. The *cat* therefore symbolizes the copious rain and the *dog* the strong wind, and the expression means *a heavy rain with wind*. EDITOR.

Some people call the male blossoms of the willow tree, which are used on Palm Sunday to represent the palm, "cats and dogs." Since they increase very rapidly after the warm April showers, the belief was entertained by superstitious people that the rain brought them. Hence the origin of the saying.

GALEN.

781. How is cotton refuse now utilized for building purposes?

ANS.—It is ground up with straw and asbestos, and moulded and pressed into blocks, which become hard like bricks and furnish a good material for building purposes.

EDITOR.

782. Why was Butler called "silver spoon"?

ANS.—His enemies falsely accused him of appropriating silver spoons to his own use, which he confiscated among the disloyalists in New Orleans, while holding that city under martial law in the civil war.

EDITOR.

783. When and where was the first S. S. started in America? H.

ANS.—The first Sunday School in America was started at Roxbury, Mass., in 1674. See *Newman's America*.

C. A. SEBBING.

NOTE.—Answers to a few queries are left for publication next month, when this department will be very interesting.

CREDITS.

- M. W. HOLLINGER, 747, 748, 749, 772.
 J. W. KECKLER, 747, 749, 779,
 J. H. W. SCHMIDT, 747, 753, 761, 770, 774, 779, 783.
 C. A. SEBRING, 745, 748, 752, 783.
 LUCY VOGT, 745, 752, 753, 774, 780, 783.
 JOHN H. KNIESLY, 767, 768, 770.
 MYRTLE GEORGE, 745.
 E. B. HIESTAND, 745, 752.
 B. F. FINKEL, 745, 749, 753.
 ED. RYNEARSON, 749, 852, 753, 761, 762, 764, 765, 766, 772.
 JOHN E. MURPHY, 771.

QUERIES.

817. What was the "famous Harvard rebellion of 1807?" J. S. H.
 818. Why do the Gulf Stream and the Japan Current flow toward the north-east? *Id.*
 819. State the influence of deeply articulated coasts upon the progress of civilization. *Id.*
 820. What are redundant letters? Explain by examples. *Id.*
 821. Can a fat man swim easier than a lean one? Why? *Id.*
 822. Give a sketch of the Savilian Professor, who is spoken of as the greatest mathematician of his age. H. A. W.
 823. During whose reign in France was the decree issued that the King's effigy should be stamped on all Moneys? *Id.*
 824. The difference between $\frac{2}{3}$ and $\frac{1}{3}$ equals the difference of their cubes; are there other such fractions? *Id.*
 825. Why is the period of time of the turning of the earth on its axis divided into twenty-four parts called hours? Why not twenty or thirty? U. H.
 826. Who wrote Washington's Farewell Address? G. M.
 827. What was called the *House of Wisdom*? The *Land of Summer*? G. B.
 828. Who is minister to Persia, China, Brazil, Cuba, Russia etc. B. F.
 829. Give the nicknames of all the Presidents. *Id.*
 830. Where are the graves of the Presidents? *Id.*
 831. Describe the phenomenon at mouth of Para River. K.
 832. Where is the "Land of the Midnight Sun"? H. L. Y.
 834. Why are some regions like the Sahara rainless, while almost constant rain falls in other places as Guinia? A. M. R.
 834. What is your authority for saying Oruro is the capital of Bolivia? W. E. ALLEN.

ANS.—The *Handbook of the United States of America, and Guide to Emigration*, giving the latest and most complete statistics, by L. P. Brockett, M. D., geographical and statistical editor of *Johnson's Cyclopaedia*. Published (1883) by Gaylord Watson, N. Y., as an accompaniment to Watson's Railroad Map. But Sucre is now the capital.

EDITOR.

Answers should be received on or before Jan. 1, 1886.

THE
SCHOOL VISITOR,

DEVOTED TO
MATHEMATICS, ENG. GRAMMAR,
EXAMINATION QUESTIONS,
NOTES, QUERIES AND ANSWERS.

JOHN S. ROYER, Editor & Publisher.

VOLUME VII.

Printed by the Editor,
1886.



EDITED BY

JOHN S. ROYER.

VOL. VII.

JANUARY, 1886.

No. 1.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

813. *By Request.*—A beat B by 80 ft. in a foot race, but if A had walked $\frac{3}{8}$ of his rate and B $\frac{3}{10}$ of his, A would have beat B by 26 ft. How far did they walk?

By GEO. C. RUSSELL, San Francisco, Cal.

Multiplying the second condition by $\frac{8}{3}$, we have A walking at his rate, B at $\frac{8}{10}$ of his rate and B beaten by $29\frac{1}{4}$ feet. Hence $80 - 29\frac{1}{4} = 50\frac{3}{4}$ feet is what B gained by increasing his rate $\frac{1}{10}$; $50\frac{3}{4} \times 80 = 4060$ feet, B walked, and A walked $4060 + 80 = 4140$ feet.

814. *By Request.*—I bought goods and paid a certain import duty on them. I marked them so as to gain 20% of the total cost, but being obliged to throw off 10% of this marked price, my gain was only 10% of the first cost of goods. What was the rate of duty?

By J. H. W. SCHMIDT, Ansonia, Ohio.

Let 100% = the first cost of goods; then $100\% + 10\% = 110\%$ is the selling price. If he throws off 10% from the marked price, he sells for 90% of it, and we have $110\% \div .90 = 122\frac{2}{3}\%$ is the marked price. The whole cost is $122\frac{2}{3}\% \div 1.20 = 101\frac{3}{7}\%$; hence the duty is $1\frac{3}{7}\%$.

815. *By A. M. SCRIPTURE, Clinton, N. Y.* A child building a cubical monument of cubical blocks of equal size found that he lacked enough for just one course. The side of the monument was x blocks. He reconstructed, with $x-1$ blocks on a side and had blocks left, out of which he built a second monument with $x-2$ blocks on a side, and a third with $x-3$ blocks, and a fourth with $x-4$ blocks on a side, which exhausted his supply. How many blocks had he?

By B. F. FINKEL, North Lewisburg, Ohio.

The whole number of blocks is $x \cdot x \cdot x - 1 = x^3 - x^2$. No. in four structures $(x-1)^3 + (x-2)^3 + (x-3)^3 + (x-4)^3 = 4x^3 - 30x^2 + 90x - 100 = x^3 - x^2$, whence $3x^3 - 29x^2 + 90x - 100 = 0$, and $x = 5$. $5^3 - 5^2 = 100$ the number of blocks.

816. By J. R. SPIEGEL, *Greensburg, Pa.*—A barn is 25 ft. square, to a corner of which a horse is tied with a rope 100 feet long. How much can he graze over?

By D. S. POND, *Rochester, Ohio.*

Let $ABCD$ be the barn, and $AE = 100$ feet the radius. The horse is tied at A and grazes in a circle to F , or $\frac{3}{4}$ of a circle, radius 100, gives 23,562 sq. ft. Angle $BGH = 13^\circ 37' 55''$, and $75 \cos BGH = GH = 72.88$ feet; also $BH \times 72.88 = \text{area } \triangle BDG$, and $\triangle BDG - \frac{1}{2}(ABCD) = 975.84$ sq. ft., area of $GBCD$. Angle $FBG = 13^\circ 37' 55'' + 45^\circ = 58^\circ 37' 55''$ and both sectors subtend an arc of $117^\circ 15' 50''$ or $\frac{8.443}{2.5920}$ of a circle whose radius is 75 feet, giving an area of 5,757 sq. ft. $\therefore$ the horse grazes over $23,562 + 975.84 + 5,757 = 30,294.84$ sq. ft.



817. By PROF. WM. HOOVER, *Athens, Ohio.*—The north declination of a star on the prime vertical, at an altitude of 40° , is 30° ; find the latitude of the observer.

By WM. WILEY, *Detroit, Mich.*

The Pole, the Zenith and the Planet are at the vertices of a spherical triangle, right-angled at Z , the co-declination being the hypotenuse. In this triangle, $\sin \text{lat.} \times \sin \text{alt.} = \sin \text{dec.}$ Hence

$$\sin \text{lat.} = \sin 30^\circ \div \sin 40^\circ = \text{sine of } 51^\circ 3' 55'',$$

which is the latitude required, being about 30 miles south of London.

818. By D. S. POND, *Rochester, Ohio.*—A wished to make a wooden cistern one foot longer than wide, and two feet wider than deep, which required 325.5 feet (surface measure) of 3-inch plank. Find outside dimensions of cistern.

Let x , $x+2$, and $x+3$ be the inside dimensions in feet; then surface of ends when sides are nailed to their edges is $2x(x+2)$. Total width of boards on sides is $2x + (2x+4) + (4 \times 3 \text{ in.}) = 4x+5$, and length of same is $(x+3) + (2 \times 3 \text{ in.}) = x+3\frac{1}{2}$; $\therefore$ the entire surface is $2x(x+2) + (4x+5)(x+3\frac{1}{2})$ or $6x^2 + 23x + 17\frac{1}{2} = 325\frac{1}{2}$, whence, dividing by 6, completing square and extracting square root, $x = 5\frac{1}{2}$ feet. Since outside dimensions exceed the inside by $\frac{1}{2}$ foot, we have 6, 8, and 9 for the required dimensions.

819. *By Request.*—The hour-hand of a clock moves 5% too fast and the minute-hand 10% too slow. In 15 minutes (true time) they will be together; how many minute-spaces are they apart now?

By J. C. GREGG, Brazil, Ind.

The minute hand moves over $\frac{1}{10}$ of a minute space in a true min. The hour hand moves over $\frac{2\frac{1}{2}}{60}$ of $\frac{1}{12} = \frac{7}{80}$ of a minute space in same time. Hence the minute hand gains $\frac{7}{80}$ of a minute space in one true minute, and $\frac{7}{80} \times 15 = 12\frac{3}{8}$ minute spaces is the required distance.

820. *By Request.*—There are 17 books on a shelf, of which 5 are of one set, 3 of another, 2 of another, and the rest are odd. Find the number of different arrangements that can be made with them, each set to be kept intact, though the order of books in it may be changed.

By A. L. FOOTE, Hempstead, Long Island.

The first set of 5 books has 120 arrangements among themselves, the set of 3 books has 6 arrangements, and the set of 2 books has 2; and the three sets may have 6 positions with reference to each other, whence we have $(120 \times 6 \times 2) \times 6 = 8640$ changes in the sets. We now take the 7 miscellaneous books in all the possible groups in which they can be joined with the sets; viz.,

1, The whole seven together. These have 4 positions with the sets and 5040 arrangements. Hence $8640 \times 4 \times 5040 = 174,182,400$ arrangements with the 7 books kept together.

Next take in two groups 6 and 1. These may have 12 positions in the sets, 720 arrangements and 7 choices of 6 in 7. Hence we obtain $8640 \times 720 \times 7 \times 12 = 522,547,200$ arrangements with 6 and 1.

Next take 5 and 2. We have 24 positions, 120 arrangements of the 5 and 21 choices of 5; $\therefore$ we have $8640 \times 24 \times 120 \times 21 = 522,547,200$.

Again, take 4 and 3. We have 72 positions with sets of any 4 unchanged in order, 24 changes of each 4, and 35 choices of different 4's. Hence we get $8640 \times 72 \times 24 \times 35 = 522,547,200$.

Next take 5, 1, and 1, and we have 24 positions, 120 changes of 5 and 21 choices of 5, or $8640 \times 24 \times 120 \times 21 = 522,547,200$.

We next take 4, 2, and 1, and have 48 positions, 24 changes of 4, and 35 choices of 4; $\therefore 8640 \times 48 \times 24 \times 35 = 348,364,800$.

Next take 3, 3, and 1. This gives 144 positions, 6 changes of 3, and 35 choices of 3, making $8640 \times 144 \times 6 \times 35 = 261,273,600$.

Next 3, 2, and 2, which gives 72 positions, 6 changes of 3, and 35 choices of 3 in 7, or in all $8640 \times 72 \times 6 \times 35 = 130,636,800$.

NOTE. The solution of Prob. 818 on the preceding page is by B. F. Finkel, North Lewisburg, Ohio. The heading was inadvertently omitted.

Next take 4, 1, 1, and 1. We then have 24 positions, 24 changes, and 35 choices, $8640 \times 24 \times 24 \times 35 = 174,182,400$.

Then 3, 2, 1, and 1, gives 48 positions, 6 changes of 3, and 35 choices of 3 in 7, or $8640 \times 48 \times 6 \times 35 = 87,091,200$.

Finally take 2, 2, 2, and 1. We have 96 positions, 2 changes of 2, and 21 choices of 2. Hence $8640 \times 96 \times 2 \times 21 = 34,836,480$.

Now we can not group the 7 books among the 3 sets in any different manner without repeating combinations already given. $\therefore$ there are in all $522547200 \times 4 + 34836480 \times 2 + 261273600 + 87091200 + 174182400 \times 2 = 3,300,756,480$ combinations.

821. By Request.—If 4 pumps, each having a length of stroke 3 feet and piston radius 3 inches, empty a cubical cistern whose side is 6 feet in one hour, what must be the radius of the piston of each of 6 pumps whose stroke is 4 ft., that they may empty a cistern whose sides are half those of the former in $\frac{1}{2}$ of an hour, there being a defect in the latter pumps taking 10% of their efficiency? By proportion.

By J. C. GREGG, Brazil, Ind.

Arranging the terms in pairs, and observing that the capacities of the pumps are as the squares of the radii, we have

$$\frac{4}{6} \times \frac{3}{4} \times \frac{216}{27} \times \frac{8}{6} \times \frac{100}{90} \times 3^2 = (1)^2; \therefore 1 \text{ in. is the radius.}$$

822. By Request.—A bridge when measured on the floor is 80 feet in length, and by looking across from one end to the other, it is found that the middle is two feet higher than the ends. If the floor of the bridge be the arc of a circle, what is the diameter of that circle?

By A. L. FOOTE, Hempstead, N. Y.

Let O be the center of the required circle of which the bridge forms an arc, ACB . Draw the chord AB , and BC , the chord of half the arc. Join OC , and let D be the point of intersection with AB .

Let $r = OC$, the radius, $DC = 2$ feet, arc $ACB = 80$ ft. $OD = r - 2$, $BD = \sqrt{r^2 - (r - 2)^2} = 2\sqrt{r - 1}$, and $AB = 4(r - 1)$. We also find the chord $BC = \sqrt{[2\sqrt{r - 1}]^2 + 2^2} = 2\sqrt{r}$. We then have the following for the length of arc:

$$[8 \times 2\sqrt{r - 1}] \div 3 = 80,$$

From which, after squaring twice and reducing,

$$r^2 - \frac{8153}{15}r = -\frac{12967201}{225}.$$

Completing square, etc., $r = 399\frac{2}{3}$ feet, and diameter = $799\frac{1}{3}$ feet.



823. By Request.—I bought $21\frac{1}{2}\%$ stock at 80% and $41\frac{1}{2}\%$ stock at 85%. The income on the former was $44\frac{1}{3}\%$ more than by the latter, but I invested \$22140 less in latter than in former; what per cent do I realize on my investment?

By AARON MOUL, *Gettysburg, Ohio.*

Let 13 parts ($144\frac{1}{2}\%$) represent the income on former and 9 parts (100%), the latter. Since the income on former is $2\frac{1}{2}\%$ on 80% , $\frac{1}{3}\frac{1}{2}$ of the investment is the income or $13 \times 32 = 416$ parts; also $4\frac{1}{2}\%$ on 85% gives $1\frac{2}{3}$ of the investment in latter for the income, or $9 \times 1\frac{2}{3} = 170$ parts; $\therefore 416 - 170$, or 246 parts = \$22140, and one part is \$90. Whole investment is $416 + 170$, or 586 parts = \$52740. The entire income is $13 + 9$, or 22 parts = \$1980. Hence $1980 \times 100 \div 52740 = 37\frac{21}{32}\%$ is the required rate.

324. *By Request.* I invest $\frac{2}{3}$ as much in 8% canal stock at 104% , as in 6% gas stock at 117% ; if my income from both is \$1200, how much did I pay for each and what was my income from each?

By GEO. C. RUSSELL, *San Francisco, Cal.*

Let 100% be the par value of the gas stock. Then it will cost 117% ; $\frac{2}{3}$ of $117\% = 78\%$ invested in canal stock; $78\% \div 1.04 = 75\%$, the par value of the canal stock: $75\% \times 8\% = 6\%$ income from canal stock; $100\% \times 6\%$ income from gas stock. As the income from each is the same, the total income from each is \$600. Hence $\$600 \div .06 = \$10,000$, the par value of the gas stock, and $\$10,000 \times 117\% = \11700 , the cost; $\$600 \div .08 = \7500 , the par value of canal stock, and $\$7500 \times 104\% = \7800 .

List of Contributors.

Our contributors will please accept our thanks for their esteemed favors. Each furnished solutions as follows:

A. M. SCRIPTURE, *Clinton, N. Y.*, 815.
 D. S. POND, *Rochester, Ohio*, 816, 818.
 WM. WILEY, *Detroit, Mich.*, 817, 820.
 J. E. GENSEMER, *Marshallville, Ohio*, 813, 814, 824.
 C. R. GEORGE, *Gettysburg, Ohio*, 813, 814, 816.
 AARON MOUL, " " 820, 821, 823, 824.
 GEO. C. RUSSELL, *San Francisco, Cal.*, 819, 814, 823, 824.
 A. M. BURCHILL, *Blyth, Ontario*, 819, 821, 823, 824.
 J. H. W. SCHMIDT, *Ansonia, Ohio*, 813, 814, 819, 823, 824.
 J. C. GREGG, *A. M., Brazil, Ind.*, 813, 814, 819, 821, 823, 824.
 HENRY GUNDER, *New Castle, Ind.*, 815, 816, 819, 820, 821, 822.
 S. S. MILLER, *Bradford, Ohio*, 813, 814, 815, 820, 821, 823, 824.
 H. C. BICKEL, *Hill Grove, Ohio*, 813, 814, 815, 816, 819, 822, 823, 824.
 R. A. LEISY, *Marshallville, Ohio*, 813, 814, 815, 816, 818, 819, 823, 824.
 B. F. FINKEL, *North Lewisburg, Ohio*, 814, 815, 816, 819, 820, 821, 823, 824.
 A. L. FOOTE, *Hempstead, N. Y.*, 813, 814, 815, 818, 820, 821, 822, 823, 824.
 GEO. G. BROWER, *Fabery, N. Y.*, 813, 814, 815, 816, 817, 819, 820, 821, 822, 823, 824.

Difficult arithmetical problems are solicited, and the mathematical department shall be very interesting and valuable. The foregoing solutions are full of interest.

By Request. ROYER'S PROBLEMS, No. 42, p. 16.—A, B, and C wish to divide a sugar loaf equally among them by sections parallel to the base. Find the altitude of each one's share, if the loaf is a true cone 20 feet high.

SOLUTION.—Let v represent the volume of the loaf, $\frac{1}{3}v$ the volume of A's portion at the top, and $\frac{2}{3}v$ the volume of A's and B's portion above C's. Since the two cones thus cut from the original are similar, and each similar to the original, we have

$$\sqrt[3]{v} : \sqrt[3]{\frac{1}{3}v} :: 20 \text{ feet} : x,$$

whence $x = 20 \sqrt[3]{\frac{1}{3}} v \div \sqrt[3]{v} = 20 \sqrt[3]{\frac{1}{3}} = 13.867 \text{ ft.}$, altitude of A's.

$$\text{Also, } \sqrt[3]{v} : \sqrt[3]{\frac{2}{3}v} :: 20 \text{ feet} : x'$$

whence $x' = 20 \sqrt[3]{\frac{2}{3}} v \div \sqrt[3]{v} = 20 \sqrt[3]{\frac{2}{3}} = 17.471 \text{ feet}$, altitude of A's and B's.

$17.471 - 13.867 = 3.604 \text{ ft.}$, altitude of B's.

And the altitude of C's share is $20 - 17.471 = 2.529 \text{ feet}$.

PROBLEM 47, p. 16.—There is a conical vessel 6 inches deep; the diameter of the top is 5 inches and it is $\frac{1}{2}$ full of water. What is the diameter of the ball, that, dropped into the water, shall just be immersed by it?

SOLUTION.—Let ABC represent a vertical section of the cup through its axis DC , and let $AB=5$, $DC=6$, $AD=2\frac{1}{2}$. Then $AC = \sqrt{(5^2 + 2\frac{1}{2}^2)} = 6\frac{1}{2}$. AO bisects the angle DAC , $\therefore O$ being equally distant from AB and AC is the center of the inscribed sphere. By similar triangles we have

$$DO : OC :: AD : AC,$$

or by composition,

$$DO + OC : DO :: AD + AC : AD,$$

or $6 : DO :: 9 : 2\frac{1}{2}$, whence $DO = 1\frac{2}{3}$,

the radius of inscribed sphere. Volume of the cup is $5^2 \times \frac{1}{2} \pi \times \frac{1}{3}$ of 6 = $12\frac{1}{2}\pi$, and the volume of the inscribed sphere is $\pi \times \frac{4}{3}$ of $(1\frac{2}{3})^3 = \frac{50}{81}\pi$.

The cup less the inscribed sphere is $12\frac{1}{2}\pi - \frac{50}{81}\pi = \frac{1025}{162}\pi$, and the amount of water in cup is $\frac{1}{2}$ of $12\frac{1}{2}\pi = 2\frac{1}{2}\pi$. Let KL be the surface of water after the ball is dropped, and let FG be the required radius. Then by the principal that two similar solids are proportional to the cubes of any two like dimensions, we have

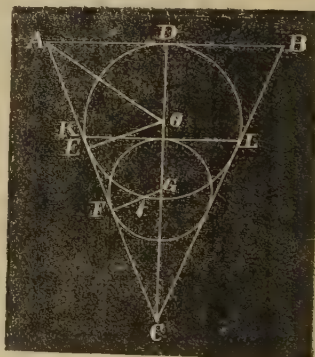
cone CAB : cone CKL :: $EO^3 : FG^3$, or cone CAB —its inscribed

sphere : cone CKL —its inscribed sphere :: $EO^3 : FG^3$.

But cone CKL less its inscribed sphere, which is the ball, is the amount of water in cup, therefore we have

$$\frac{1025}{162}\pi : 2\frac{1}{2}\pi :: (1\frac{2}{3})^3 : (FG)^3,$$

whence $FG^3 = \frac{7}{4}$, or $FG = 1.223 + \text{in.}$, and the diameter is $2.446 + \text{in.}$



Problems for Solution.

845. A merchant buys a bill of goods amounting to \$2480; he can have 4 months' credit, or 5% off for cash; if money is worth only 10% to him, what will he gain by paying cash? E. R.

846. Suppose A and B work together for 4 hours, after which A leaves and B does the remainder in 3 hr. 36 min.; but if B had left, it would have taken A 4 hr. 30 min. to finish the work. Find by arithmetic in what time each could have done it alone. ROYER'S PROBLEMS.

847. A, B, and C start at noon from the same point to travel around a circle of 390 rods. A walks 7 rd. and B 13 rd. per minute the same way; C travels 19 rd. per minute in an opposite direction. At what time will the three meet at the starting point, each traveling at a uniform rate? Id.

848. John Bernoulli found that the sum of the series, $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \dots$, etc., equals $\frac{1}{6}\pi^2$. How did he find it? H. A. WOOD.

849. A grocer who sells 7 lbs. of butter for the price which he pays for 8, determines to cheat both in buying and selling, by means of a false balance, 13 lb. in one scale balancing 14 lb. in the other. By this dishonesty he increases his profits by \$29 on a quantity of butter. What does he pay for that quantity? A. M. BURCHILL.

850. The teachers in a school are $\frac{1}{24}$ of its whole number of persons, but after 40 new boys have been added the masters being $\frac{3}{80}$ of the whole. How many boys were there before the new boys came? Id.

851. A man bought 50 bu. of grain, paying 75 cents for rye and \$1.25 for wheat; how many bushels of each did he buy, if the grain cost him \$52.50? G. M. MORRIS.

852. How many miles of furrow 15 in. wide, is turned in plowing a rectangular field whose width is 30 rods and length 10 rods less than its diagonal? GEO. L. SHANER.

853. Otto Guericke's hemispheres are said to have been 2 feet in diameter. It is sometimes stated that 30 horses, 15 on each side, were unable to pull them apart. Can that be true? J. C. CORBIN.

854. A, B, and C having 4 loaves for which A paid 5c., B 8c., and C 11c., eat 3 loaves and sell the fourth to D for 24 cents. Divide the 24c. equitably. L. A. M.

855. A drover paid \$76 for calves and sheep, \$3 for calves and \$2 for sheep; he sold $\frac{1}{2}$ of the calves and $\frac{2}{3}$ of the sheep for \$23; and in so doing lost 8% on their cost; how many of each did he purchase? A. M. SCRIPTURE.

Solutions should be received on or before Feb. 10.

NOTE ON SOLUTION OF 806.—The coefficients 3, 4, 5 are connected by the relation $5^2 = 3^2 + 4^2$. Any other numbers a , b and c connected by the relation $c^2 = a^2 + b^2$ may be substituted for 3, 4, 5 and will give an indefinite number of solutions. J. C. CORBIN.

J. C. ROEBUCK, of Rockfalls, Iowa, says that he found the highest prime number to be 140,737,488,355,327, corresponding as the prime number for the last perfect number in Prob. 678, p. 28, Vol. 6.

We have a few papers on special problems in mathematics, which will be published as soon as space will permit. In the next issue some problems will be proposed of a higher grade.

Our *Problems in Mathematics* was prepared for advanced classes, and can be procured for one dime by addressing *The School Visitor*. We have now a class of seven that are unfolding some of the beauties of the science by their solutions. The edition is nearly sold, and persons interested would better secure a copy at once.

Examination Questions.

ARITHMETIC.

1. Write the product of 123 and 45 in words, in the Roman notation, in the Arabic notation.

Ans.—Five thousand five hundred and thirty. $\overline{\text{V}}\text{DXXXV}$. 5535.

2. Find the square root of $384\frac{1}{2}$ to five decimal places.

Ans.—We get 19.61049.

3. If 3 be $\frac{2}{3}$ of 4, what will $\frac{1}{5}$ of 18 be?

Ans.—There are two methods by which such ridiculous problems may be solved. Two solutions of a similar problem were published in the Nov. *Visitor* to settle a dispute among teachers in a certain institute. The magazine is considered good authority, because its contributors rank among the best mathematicians in the country.

Now, if 3 is $\frac{2}{3}$ of 4, then $\frac{2}{3}$ of a certain number must be $\frac{3}{4}$ of the same number and *vice versa*, which is absurd. If we take $\frac{2}{3}$ as $\frac{4}{3}$ (which is $\frac{2}{3} \times \frac{2}{3}$), then $\frac{1}{5}$ is $\frac{2}{3} \times \frac{1}{5} = \frac{2}{15}$ and we have $\frac{2}{15}$ of 18 = $4\frac{1}{3}$, first answer. But if we take $\frac{2}{3}$ as $\frac{3}{4}$ (which is $\frac{2}{3} \times \frac{3}{4}$), then $\frac{1}{5}$ is $\frac{3}{4} \times \frac{1}{5} = \frac{3}{20}$ and we have $\frac{3}{20}$ of 18 = $3\frac{1}{2}$, second answer. The first is preferable, for by the general rule given by Prof. Wood on p. 201, Vol. 6, we have $\frac{2}{3}$ of 4 : 3 :: $\frac{1}{5}$ of 18 : ($4\frac{1}{3}$) Ans.

4. If 100 lb. be carried 20 miles for 20 cents, how far will 5050 lb. be carried for \$60.60?

Ans.—By proportion we have $\frac{100}{5050} \times \frac{6060}{20} = 120$ mi.

5. A man sold a horse for \$120, and thereby gained $\frac{1}{5}$ of its cost: what would he have lost per cent by selling it for \$80?

Ans.—The horse cost $\$120 \div \frac{6}{5} = \100 ; by selling for \$80, he would lose $20 \div 100 = 20\%$.

6. Write three notes each from the following data: Principal, \$100; maker, Henry Insolvent; payee, James Collectible; interest, 6% after maturity; time, 6 months; place, Greenville, Ohio; date Jan. 2d, 1886. First note, not negotiable; second, negotiable if endorsed; third negotiable, without endorsing.

Ans.—The following note answers the first condition:

\$100

Greenville, Ohio, Jan. 2, 1886.

Six months after date I promise to pay to James Collectible, One Hundred Dollars. Six per cent interest after maturity.

HENRY INSOLVENT.

For the second condition, insert the words *or order* after *Jas. Collectible*. For the third, insert *or bearer*.

7. What income in currency would a man receive by investing \$10,440 in U. S. 5-20 6 per cent bonds, at 116, when gold is 105?

Ans.—The face value of bonds is $\$10440 \div 1.16 = \9000 ; income in gold is 6% of \$9000 = \$540, and in currency, $\$540 \times 1.05 = \567 .

8. Explain fully how you teach that 1 hr., 1 min., 1 sec., of time equals the corresponding equivalents of longitude, given in the arithmetics.

Ans.—The earth makes one revolution on its axis in 24 hours, and any point in its surface, not at the poles, describes the circumference of a circle, which is 360° . The arc described by such point in one hour is $360 \div 24 = 15^\circ$; hence

it is said that 15° of longitude make one hour of time. Any point then moves 15° or $900'$ in one hour or 60 min.; hence $900' \div 60 = 15'$ of longitude make one minute. Also $15' = 900''$ in 60 sec.; therefore $900'' \div 60 = 15''$ make one second.

9. A note of \$2000, dated July 4, 1876, due May 1, 1878, and bearing interest at 8% was cancelled Oct. 25th, 1877, by payment of the present worth at 6 per cent; what was the present worth, at this date, and the discount?

Ans.—The amount of this note from July 4, 1876 to May 1, 1878, at 8% is $\$2000 \times 1.146 = \2292 ; the present worth of this amount from Oct. 25, 1877, to maturity at 6% is $\$2292 \div 1.031 = \2223.08 ; and the true discount is $\$2292 - \$2223.08 = \$68.92$.

10. A person being asked the hour of the day, replied, " $\frac{2}{3}$ of the time past noon equals $\frac{2}{3}$ of the time from now to midnight plus $2\frac{2}{3}$ hours;" what was the time?

Ans.—The time past noon is $\frac{2}{3}$ of ($\frac{2}{3}$ of the time to midnight $+ 2\frac{2}{3}$ hr.,) or $\frac{1}{3}$ of the time to midnight $+ 4$ hr., to which add the time to midnight, and we have $\frac{4}{3}$ of the time to midnight $+ 4$ hr. $= 12$ hrs. (noon to midnight). Then $\frac{4}{3}$ of the time to midnight is $12 - 4 = 8$ hrs. and the time is 6 o'clock.

GEOGRAPHY.

1. Name and define the three divisions of Geography.

Ans. —*Mathematical*, which treats of the solar system; *Physical*, of the natural features of the earth; *Political*, of the various divisions, etc., of the earth's surface. See text-book.

2. Name the predominate mountain chain and culminating point of each grand division.

Ans. —Himalaya, Mt. Everest (29,000 ft.); Andes, Mt. Aconcagua (23,900 ft.); Chain along eastern coast of Africa (no name), Mt. Kenia (20,000 ft.); Rocky, Mt. St. Elias (19,500 ft.); Alps, Mt. Blanc (15,810 ft.). These given statements are reliable being based on the most recent and careful observations. See Monteieth's New Physical Geography. (1885). Mt. Sorato, formerly considered the highest peak of the Andes, is now reduced to 21,286 feet. Mt. Chimborazo, once known as the highest on the globe, is only 21,424 feet high. Mt. Elboorz (17,796 ft.) in the Caucasus Mts. is higher than Mt. Blanc, but being at the boundary we place the latter in the list above.

3. Describe the difference between a delta and an estuary.

Ans. —Most large rivers form deltas. The Mississippi will always bear its burden of silt which is deposited at its mouth in the Gulf of Mexico. This gulf formerly extended at least as far north as St. Louis and it will decrease in size until it may become dry land. The deltas of the Nile, Ganges, Po, Orinoco, etc., are noted, that of the Po having been built with remarkable rapidity. In the time of Augustus Cæsar, Adria, was a seaport; it is now over 20 miles inland. An *estuary* is the opposite of *delta*, and is formed by an arm of the sea extending into the land, and meeting the river.

4. Define forms of relief.

Ans. —Mountains, plateaus, and plains are the principal forms of relief, and a careful study of these, show that the evolution of the earth's features has been regular. Each continent has high borders and a low interior; the greatest length is in the direction of its principal mountain system; each is triangular, the highest mountains border the largest and deepest ocean; and the greatest elevations of land are in the torrid zone.

5. Describe the largest continental river in the world.

Ans.—The Volga is a continental river because its waters do not reach the ocean, and is the largest of its class. It rises in the marshy plains about the Valdai Hills, 633 feet above the level of the Caspian Sea into which it empties by about 70 mouths. Its length is 2500 miles, and contains an abundance of fish. It is the principal channel of commerce in Russia, and is connected by canals with the Baltic, White and Black seas. Its waters are frozen over for nearly half the year.

6. What are winds? How caused? Describe the three classes.

Ans.—There is a striking analogy between the motion and direction of the atmosphere and those of the ocean currents. The sun is the prime cause of both. Winds are currents of air, and are either constant or periodical. Of the former are the trade winds, passage winds, polar winds, monsoons, the land-and-sea breeze, etc. Then we have typhoons, cyclones, tornadoes, hurricanes, whirlwinds, the northers, helmwinds, puna winds, etc., of the latter.

7. Egypt is a rainless country. Is it productive or unproductive? Why?

Ans.—It is highly productive, because all the cultivable land is wholly the deposit of the Nile, which overflows and inundates the country. This inundation, however, is regulated to some extent by closing the mouths of the canals during the flood. Artificial irrigation by means of lakes, canals, dams and dikes, is used during the low water season. Wheat, cotton, and sugar-cane, from which excellent sugar is made, are the staples. The vegetables are abundant and varied, so that it is no wonder the children of Israel longed for them in the desert.

8. Name the capital of each of the following: Dakota, Wyoming, Arizona, West Virginia and Nevada.

Ans.—Bismarck, Cheyenne City, Prescott, Charleston, Carson City.

9. Name the physical divisions of the U. S.

Ans.—Atlantic Coast Plain, Mississippi Valley, Great Plains, Great Basin, Pacific Coast Plain, the Appalachian and Rocky Mountain systems.

10. What and where are the following: Okeechobee, Tulare, Pontchartrain, Maracaybo, Onega, Titicaca, Tsad, Manila, Honolulu, Lands End.

Ans.—First seven are lakes, located, respectively, in Fla., Cal., La., Venezuela, Russia, Bolivia, and the Soudan. Next two are the capitals of Philippine and Sandwich Islands. Land's End is a celebrated headland forming the western-most land of England. It is formed of granite cliffs, about 60 feet high. About a mile west are the dangerous rocks called Longships, with a light house 88 feet high.

HISTORY.

1. Name five eminent American Historians.

Ans.—Bancroft, born at Worcester, Mass., in 1800, is the greatest living historian of America, whose home is among the picturesque cliffs near Newport, R. I. He filled the office of Secretary of Navy, of Minister to England and to Germany, with dignity and honor, and is yet engaged on his great work, a *History of the United States*.

William H. Prescott, one of the greatest historians, was born at Salem, Mass. in 1796. Though nearly blind, he devoted himself to a literary life. He is the author of *Ferdinand and Isabella*, *Conquest of Mexico*, *Conquest of Peru*, etc. He

had the genius to invest the dry facts of history with the charms of fiction. He died in 1859.

John Lothrop Motley was born at Dorchester, Mass., in 1814, and died in 1877. He filled several diplomatic appointments, and wrote—*Rise of the Dutch Republic, History of the United Netherlands, John of Barneveld*, etc. In vigor and brilliancy of style, he is surpassed only by Macaulay.

Benson John Lossing, watchmaker, wood-engraver, journalist, editor, and historian, was born in Dutchess Co., N. Y., 1813, and is the author of the *Pictorial Field-Book of the Revolution, History of the War of 1812, Pictorial History of the Civil War*, etc.

Richard Hildreth, (1807-1865) wrote a valuable History of the U. S. in 6 vols.

2. Describe the cause and result of Bacon's Rebellion.

ANS.—The cause was the tyrannical government of Berkely and his neglect to protect the lives and property of Jamestown colonists against the invasion of the Indians. The result was the burning of Jamestown, the demise of Bacon, the restoration of Berkeley, and the execution of 22 of Bacon's followers. Hansford was the first partisan leader that was condemned to death by Berkeley, and was the "first white native of America that perished by the gibbet."

3. State what you know of the Railroad Riots of 1877.

ANS.—They began July 17, when the employes of the B. & O. Railroad refused to work. Special violence was shown at Martinsburg. On the 18th a riot commenced in Pittsburg, and on Saturday, July 21, when the Pa. Militia arrived at Pittsburg, a scene of riot and violence occurred never surpassed in any American city. Chicago suffered by a reckless mob. Similar scenes were enacted at St. Louis and San Francisco. By July 30th the convulsion had subsided.

4. What was the council of Burgesses? For what purpose established.

ANS.—It was the first colonial assembly ever called in America, and was the genesis of legislative liberty in the New World. It was composed of Gov. Geo. Yeardley, a newly appointed council and 22 representatives from 11 boroughs into which the colony was divided. They met at Jamestown and had a solemn inauguration July 30, 1618. It was created to form a constitution and government for the colony, but owing to diversity of opinions their work was tedious. The first written constitution ever issued in this country was presented by this body July 24, 1621, which provided for a legislative body, and for trial by jury as in England.

5. Name the 13 original colonies.

ANS.—N. H., Mass., R. I., Conn., N. Y., N. J., Pa., Del., Md., Va., N. C., S. C., and Ga.

6. What was the Burlingame Embassy?

ANS.—Anson Burlingame was appointed by Lincoln Minister to China, and in 1867 he resigned his position, much against the will of Prince Kung and the Chinese officials. At length the imperial officers placed him at the head of a Chinese embassy to make treaties with all civilized nations. They arrived at San Francisco Feb. 25, 1868, and in May closed the first treaty between the U. S. and China, establishing commercial relations.

7. Who were the Grangers? What caused the organization of that society?

ANS.—The Patrons of Husbandry date their organization Dec. 4, 1867, when Wm. Saunders, Sup't of the gardens in the Dep't of Agriculture in Washington,

and a few others organized a National Grange, for the promotion of the farming interests of the country. They spread all over the country, until in 1876 19,000 subordinate granges were in existence. The objects were three-fold: 1, To elevate the condition of the farmer; 2, To increase the value of his products; 3, To put him in direct communication with the consumer. The "Middle Man" was to be excluded. The enthusiasm of the Order has died out to a great extent.

8. Describe the settlement of Rhode Island.

Ans.—Roger Williams with five companions established the first settlement at Providence which he named, July 4, 1836. Then followed another exile from Mass. Bay Colony, in the person of Mrs. Anne Hutchinson, who, with a number of friends, founded a settlement on Aquiday (*the isle of peace*), in the Naragansett bay, which they bought from the Indians and named it, the Isle of Rhodes. In 1839 Newport was founded near the famous old stone tower. These two colonies were united in 1644 under the name of Rhode Island and Providence Plantations.

9. What congress is now in session at Washington?

Ans.—The 49th.

10. Who is the acting Vice President of the U. S. How was he placed in office?

Ans.—John Sherman, who was lately elected by the Senate.

SPELLING.

Burglary, menace, anise, flageolet, complainant, surveillance, indelible, Beauteous, erasure, immaculate, sinister, deleble, Mississinawa, frieze, J. H. Drummond, M. A. and LL. D., M. Swing, Ph. D., J. E. Taylor, M. D., beginning, pollen.

GRAMMAR.

1. What is declension? Decline I, thou, she, what, and Mary.

Ans.—Declension is a regular arrangement of the case and number of nouns or pronouns. *What* is not declined. For the others see text-book.

2. Write the plurals of it, her, this, so, Susan, index, himself, Mr., Mrs., Dr., and Miss.

Ans.—They. Their or them. These. Sos. Susans. Indexes or indices. Themselves. Messrs. Mesdames, abbreviated Mesmes. Drs. Misses.

3. What is personification? Give examples. Give a general rule for determining the gender of personified nouns.

Ans.—*Personification* is a figure of rhetoric by which the absent are introduced as present, and by which inanimate objects and abstract ideas are represented as living. The rule is to apply the masculine to things remarkable for power, greatness or sublimity; as, Lo, steel-clad *War* his gorgeous standard rears! *Death*, the grim monster, has conquered. The *sun* governs the day with wonderful regularity. The feminine is applied to things beautiful, amiable, and prolific; as, Hark! *Truth* proclaims her power and thy triumphs cease. The *earth* has lost her glory. The *moon* hid her face beneath the clouds. *Greece* cries to us from the poisoned lips of her Demosthenes. *Freedom* shrieked as Kosciuszko fell.

4. Give an outline of the adjective.

Ans.—Adjective—Descriptive and Definitive; Descriptive—Common, Proper and Participial; Definitive—Articles, Pronominal, and Numeral; Articles—Definite and Indefinite; Pronominal—Demonstratives, Distributives and Indefinites; Numeral—Cardinal, Ordinal and Multiplicative.

5. When the subject consists of words differing in person, how is the form of the verb or pronoun determined?

Ans.—The verb must agree with the one nearest it.

6. What does a verb in the indicative express? In the subjunctive? In the potential? In the imperative?

Ans.—Direct assertion or interrogation. Conditional assertion. Assertions implying possibility, contingency, or necessity. The will of the speaker.

7. What parts of speech are never modified?

Ans.—Conjunctions, prepositions and interjections.

8. Define a sentence, phrase, clause, proposition. Give examples of each.

Ans.—All discourse can be resolved into sentences; sentences into propositions; propositions into phrases and words; and words into syllables and letters. Therefore, a sentence is a thought expressed by a proposition or a union of propositions, followed by a full pause; a proposition is a subject combined with a predicate; a clause is a proposition that makes but a part of a sentence; and a phrase is two or more words rightly put together, but making no proposition.

ADJECTIVE PHRASE AND CLAUSE.—Give me questions *suitable for me*. The place *where he was buried* could not be found.

POSSESSIVE PHRASE.—I went to *Brown and Smith's* store.

APPPOSITIVE PHRASE AND CLAUSE.—Greenville, *the county-seat of Darke*, is a flourishing town. The statement of Columbus, *that so large a river must come from a continent*, was verified.

PARTICIPIAL PHRASE.—The prisoners *captured in the first battle* have been released.

INFINITIVE PHRASE. I have no desire *to be considered one of his friends*.

PREPOSITIONAL PHRASE.—A cup *of alabaster* and a bouquet *of beautiful fresh flowers* were *on the table*.

ADVERBIAL PHRASE AND CLAUSE.—I will go *by and by*. The house will be sold *if he can not pay for it*.

(OBJECTIVE PHRASE AND CLAUSE.—She said, "*A penny for your thoughts*." I know *that he is honest*.

SUBSTANTIVE PHRASE AND CLAUSE.—"*Asail ahead*," was the startling alarm. *That you remain with us*, is the wish of all.

RELATIVE CLAUSE.—The man *whom you saw* was my friend.

9. Write a sentence in which a passive verb governs a noun in the objective case and parse the verb and the noun.

Ans.—He was allowed great liberty.

10. The *stability* of our *own* government, *compared with* the radical changes in *those* of every other civilized nation *during* the past *ninety-eight* years, is an honorable *memorial* of the political wisdom of the men who framed the Constitution of 1787, *and* of their descendants who have expounded and obeyed it.—Diagram and parse italicized words.

[stability	the compared with changes of government our	in [governments]	those of nations	every other civild
[is-memorial	an honorable of wisdom and of descendants	the political of men [who framed constitution	the past ninety-eight the of 1787	
		their [who have expounded and [] obeyed it		

The foregoing list was used Jan. 2, when 59 applicants were present, of whom 32 failed. Our answers are deemed complete and embrace instructive matter. Teachers and those who are preparing to teach will do well by taking the *Visitor* this year. The Board has decided to raise the standard and give certificates to those only whose work merits license to teach. There will be two examinations in February, in March and in April, the first and the third Saturdays respectively. We shall be present at each of these examinations to take subscriptions and to collect arrearages.

At the last examination it was a pleasure to meet old friends and to add new names to the list. H. C. Bickel and Florence Rohr secured full sets of *Visitor* as far back as could be furnished. C. A. Sebring likewise filled up his set. We shall have with us at each examination bound volumes of preceding years which will be for sale at special rates. Those who do not have full sets should secure them then. The same opportunities will be given at Ansonia during the meeting of the teachers' association, Jan. 23.

If the readers of this magazine detect clerical or typographical errors in any issue, that should be corrected, they will confer a favor by calling our attention to it. We aim to present correct and reliable matter.

We have purposely delayed the issue of this number to enable us to arrange the books for 1886. For at least four months, the *Visitor* will not be mailed before the middle of the month. If subscribers should not get certain numbers, they would better notify us at once.

The programme for the teachers' meeting at Ansonia, Jan. 23, embraces the following subjects: *The Young Teacher*; *The School Ventilation*; *Emotions as a Power in Discipline*; *Arithmetic in Country Schools*; *Browsing Among Books*; *How the Country Schools may be Improved*. This is a lengthy programme for only one short day. The spirited discussion on the last theme at Versailles will likely bring a good attendance. Let the country teachers speak and give the status of the country schools. The people of Ansonia are generous and noble, who will give our friends a hearty welcome. Attend, if possible.

ERRATA.—Page 11, in answer to 9th question in Arithmetic, 3d line, in 2262, change "6" to 9.

Page 17, answer to No. 757, 2d line, read *Saracens*, and place the name H. A. Wood to answer of No. 756.

Page 24, add to the credit of Geo. L. Shaner, 784, 794, 795, 801, 813, 814, 815.

Page 240, No. 12, Vol. 6, first word in spelling list should be *supersedure*.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

863. What is the meaning of ss. used in legal writings? As, State of Ohio, ss. J. L.

Ans.—The abbreviation is a modification of *st*, the initials of *seire licet*, meaning, it may be known, or is lawful to know. EDITOR.

864. How are the double letters æ, œ, etc., written in script?

Ans.—By drawing a curve over the two letters to be thus combined. ED.

865. Why is the sun *fast* or *slow*? Id.

Ans.—Because the length of the solar day changes in consequence of the varying distance of the earth from the sun, caused by the elliptical form of the earth's orbit. The inclination of the earth's axis, also has something to do with the variation. EDITOR.

866. Who is "George Eliot"? QUEERIST.

Ans.—She was the greatest female novelist England ever produced and probably no one ever surpassed her. She is as supreme in fiction as Mrs. Somerville in science, and Mrs. Browning in poetry. Her maiden name was Marian C. Evans, born in the north of England about 1820, and died in London Dec. 22, 1880. She lived with the celebrated writer Geo. H. Lewes, for some years as his wife, and subsequent to his death in 1878, she married a gentleman by the name of Cross. Her best novels are *Weaver of Raveloe*; *Romola*; *Felix Holt, the Radical*; *Middlemarch*; *Daniel Deronda*; *Silas Marner*; *Scenes of Clerical Life*; *Adam Bede*, and *The Mill on the Floss*. Her poems, *The Spanish Gypsy* and *The Legend of Jubal and Armgart* are not so excellent. EDITOR.

344. What is the origin and use of *Tally-ho*?

Ans.—It is derived from the Norman hunting cry, *Tailis au!* which means, *to the coppice*. The tally-ho was used when the stag was viewed in full career making for the coppice. We now cry "Tally-bo!" when the fox breaks cover. *This hillant!* is the French cry.—Brewer. EDITOR.

688. Who was "Judas of the West"?

Ans.—In the famous scrub race for the presidency in 1824, the personal contest among the four candidates, Wm. H. Crawford, J. Q. Adams, Henry Clay and Andrew Jackson, was quite animated, and when the Clay faction in the House favored M. Adams, who was elected on the first ballot, Mr. Jackson became highly incensed and stigmatized Mr. Clay as the *Judas of the West*. JOHN FITZGERALD.

756. What spring was changed by earthquake from cold to hot?

Ans.—During the great earthquake at Lisbon, Nov. 1. 1755, in which 60,000 persons perished, a spring in the Pyrenees was suddenly changed from a cold spring to one of 122° F., and it has retained this warmth ever since.

757. Who was the "Golden-footed Dame"?

Ans.—During the first crusade to recover Jerusalem, the city was taken; but about half a century later, the swarming Laracens seemed about to overwhelm the little Frank kingdom in Palestine. St. Bernard preached a new crusade. Louis VII. of France and Conrad III. of Germany led across Europe three hundred thousand men. Louis was accompanied by queen Eleanor, leading a body of women clad in knightly array; and Conrad was followed by a similar band, whose chief, with her gilt spurs and buskins, was called the Golden-footed Dame. H. A. Wood.

758. What ruler occupied a different bed every night?

Ans.—Louis XI. of France was selfish, cruel, and false to all sense of honor and affection, and has been called “the wickedest son and the worst father in French annals.” He recoiled with great terror at the thought of death which he had inflicted on so many. He besieged every saint in heaven for the prolongation of life, weighed himself down with mouldering relics, and is said to have even drunk the blood of infants to revive the failing current of life. He shut himself up in the castle of Plessis, where he grew daily more pitiless and fanatical. Says Edwards: “About this castle were ten thousand mantraps, placed in the ground, and passers-by could not approach within a league. Suspicious persons were hung instantly without form of trial. There was scarcely a tree in the forest but bore on its branches the body of some hapless trespasser, while corpses lay on the ground like bones around the lair of a wild beast. The king lived in a suite of thirty rooms, which communicated with one another, and were secured by six complicated locks. No one knew in which bed he slept, and he never inhabited the same room, or slept upon the same bed, for two consecutive nights.”

H. A. Wood.

759. What was the Tennis-court oath?

Ans.—In 1789 France was being profoundly stirred by those exciting events preceding the reign of terror. The States-General were convened with great pomp. Much was expected of this body of which France had been so long deprived. The strength of the Third Estate soon made itself felt. The first question that arose was whether the three bodies should vote collectively or separately. The nobles and clergy having retired, according to custom, the *tiers-etat* refused to act until they returned. After five weeks spent in useless parleys, the Commons decided itself to be the National Assembly. Louis thereupon closed the hall and suspended the meetings. The members then withdrew to a *tennis-court* near by, and solemnly swore not to separate until they had given France a constitution. This is known as the Tennis Court oath.

H. A. Wood.

784. What is the *Circle of Illumination*?

S.

Ans.—It is a great circle of the earth, dividing the hemisphere of light from that of darkness.

B. F. FINKEL.

785. Is Geo. Bancroft living? If so, where?

U.

Ans.—He is still living. He makes Newport, R. I., his residence in summer, where he celebrated his 85th birthday Oct. 3, and in the winter he resides at Washington, D. C. He is continuing to collect materials for his great work.

A History of the United States.

URIAH H. DANIELS.

786. Why was the eagle chosen emblem of the U. S.?

L. M. O.

Ans.—Because he is the king of birds, and in heraldry is an emblem of fortitude and magnanimity.

ED. RYNEARSON.

787. What was the “X-Y-Z Treaty”?

Ans.—In October, 1797, an American mission was appointed, to go to France and negotiate peace. Charles C. Pinckney, John Marshall and Elbridge Gerry accordingly proceeded to France, but were refused reception by the government, unless large sums of money were first paid to the French officers. Here Pinckney made his famous reply, “Millions for defence but not a cent for tribute.” The envoys finally returned home without effecting a result. The name of this mission originated in the fact that the suggestions relative to bribes to the French, were made in letters written over the signature of X. Y. Z. Those letters were afterwards obtained by England, and published through Europe.

URIAH H. DANIELS.

788. Whence came the superstitious fear of spilling salt?

Ans.—*Spilling salt* was held to be an unlucky omen by the Romans. Salt was used in sacrifice by the Jews, as well as by the Greeks and Romans; and it is still used in baptism by the Roman Catholics. It was an emblem of purity and the sanctifying influence of a holy life on others. Hence the disciples were "the salt of the earth." Spilling the salt after it was placed on the hand of the victim was considered a bad omen; hence the superstition. EDITOR.

789. Who made the first marine chronometer?

W.

Ans.—John Harrison (1693-1776) an eminent mechanician, born at Faulby, England, was the son of a carpenter. He learned his father's trade, but soon engaged in mechanical pursuits. He devised his ingenious "gridiron pendulum" in 1726, and the principle of compensation used in its construction is now applied to all good watches and chronometers. His "recoil escapement" which obviated the necessity of oil, and the form of "going ratchet", which is a spring arrangement for keeping the time piece going regularly during the interval of winding up, were improvements introduced by him. Though various suggestions were made without effect, Harrison's vigorous efforts were successful. His first time piece for the prize was made in 1735, the second in 1739, the third in 1749, the fourth in 1755, and in 1761 his instrument was put on trial in a king's ship to Jamaica, which it reached 5" slow. On the return to Portsmouth, after five month's absence, it was 1' 54" wrong, showing an error of 18 miles only. He received the highest prize. It is said that Gemma Trisius in 1530 made the first proposition to determine longitude at sea by means of a time piece and observation for noon. Denison states that Earnshaw brought the chronometer to its present perfection. See *Knight's American Mechanical Dictionary* (chronometer), and the biography of John Harrison in *Cyclopedias*, etc. The prize alluded to is explained in next answer. EDITOR.

To ascertain longitude by means of a watch, a chronometer must accompany it showing the exact time at Greenwich, or any place determined upon. The problem of applying this to determine longitude at sea, remained for a long time inaccurately solved for want of good watches. At the instant of twelve by the watch, the difference between this time and the chronometer gives the longitude. In 1598, Philip III. of Spain offered a prize of 1000 crowns for the solution of the problem; the Duke of Orleans, Regent of France, offered in the name of the king 100,000 livres; and the French Academy annually awarded a prize to those who made the more useful discoveries connected with the discovery. In 1714, a committee, among whom was Sir Isaac Newton, suggested the discovery of the longitude by the dial of an accurate time-keeper, and the legislature of Queen Anne passed an Act granting £10,000 if the method found discovered the longitude to a degree, or sixty geographical miles, £15,000 if to forty miles, and £20,000 if to thirty miles; to be determined by a voyage from a port in Great Britain to any port in America. For nearly a century and a half all alike failed, when the great discovery was made by a self-taught genius, John Harrison, born at Faulby, near Pontefract, 1693. He was bred a village carpenter, and early manifested a taste for mathematical science, having made two wooden clocks, without having received any instruction in the art. In 1736 he completed the *first chronometer used at sea*, which neither varied from change of temperature nor the motion of the vessel. About 1739 he made a smaller and improved chronometer, which was still further improved in 1741 when he received the society's gold medal. In 1761, in a second test voyage, his chronometer determined the position of the Barbadoes within the required limit and the £20,000 was then awarded to him. H. A. WOOD.

790. Describe the "Gigantic Silver Fountain."

Ans.—I see stated in *Maglot's Manual of Geography* that the "Famous Silver Spring" is a little above the mouth of St. Johns. It forms a deep basin of water which wells up from the bowels of the earth with much force, forming a lake of five acres in area. The water is fresh, clear as crystal, and eighty feet deep. B. F. FINKEL.

791. How many asteroids, discovered up to the present?

Ans.—Monteith's *New Physical Geography* says 240. Maglot's *Manual*, 238.
EDITOR.

Prof. Piazzi, of Palermo, discovered the first of the great group of Asteroids Jan. 1, 1801, and named it Ceres. Of the two hundred and thirty of these planetoid bodies, the fiftieth one found, and the first one discovered in America, was first seen by Prof. Ferguson, of Washington, D. C., and was named Virginia. Professors Watson and Peters have been the most successful American asteroid hunters.—*Notes, Queries & Answers*.
J. H. W. SCHMIDT.

792. Will a fire burn more rapidly at night? Why?

Ans.—Ordinary combustion is due to the union of the oxygen of the air with the carbon and hydrogen contained in the coals, oils, and gases of our fires and flames. At night the air is more homogeneous than in the day time, consequently, the fire burns more rapidly then.
J. H. W. SCHMIDT.

793. Name the best English writers on Education.

FAY.

Ans.—The following list includes the best English writers on education and their works:

Joseph Payne's *Lectures on the Science and Art of Education*.
Fitch's *Lectures on Teaching*.
Lotham on the *Action of Examinations*.
Curries *Common School Education*.
Walker's *Handy Book of Object Lessons*.
Lawries *Training of Teachers*.
Gill's *System of Education*.
Quick's *Educational Reformers*.
Fearson's *School Inspection*.
Blackison, *The Teacher*.
Millinger's *Schools of Charles the Great*.
Arnold's *Higher Schools and Universities of Germany*.
Combe's *Education*.
Robinson's *Manual of Methods*.
Calderwood's *On Teaching*.
Bain's *Education as a Science*.
Spencer's *Education*.
Thwing's *Education and School*.
Maclaren's *System of Physical Education*.
Locke's *Thoughts Concerning Education*.
Ascham's *Schoolmaster*.

J. H. W. SCHMIDT.

794. Who have written standard histories of the U. S.?

Ans.—Bancroft, Prescott, Hildreth, Ridpath, Lossing. Newman, McCabe, Barnes and others.
ED. RYNARSON.

795. Who was Copernicus? What did he teach?

Ans.—Copernicus was an astronomer, born in Thorn, Prussia, Feb. 19, 1473. His astronomical studies convinced him of the earth's annual motion and the sun's immovability as the center of the solar system. But as the Ptolemaic theory was implicitly believed, and contrary teaching was denounced as heresy, he delayed the publication of his theory. A printed copy of his work in which he embodied his views, was placed in his hands a few hours before his death, which occurred May 22, 1543.
MATTIE HARLEMAN.

796. Give causes that led to the downfall of Rome.

Ans.—The fall of the Roman empire was in the order of Nature, which has set a limit to all things human, but when the nobles and men of property were

immersed in luxury and sensual indulgence; when the country was depopulated or filled only with slaves, the cities thronged with an idle, beggarly, turbulent population, vigorous only for evil; when the provincials were so beaten to the earth by excessive taxation, that the rule of barbarian conquerors was looked to as an alleviation; when the noble, elevating, soul-expanding religion of the Gospel had been degraded by oriental asceticism into a slavish, enervating superstition; when, finally, the defense of the empire against the barbarians was entrusted to the barbarians themselves. —its fall was assured and a new order of things was to arise out of the union of German energy with Roman civilization.

J. H. W. SCHMIDT.

797. What and when was the "Thirty-years' War"? G. S.

Ans.—Germany was the theatre of a succession of wars from 1618 to 1648. They arose from differences of religious faith. The two noted men during this war were Gustavus Adolphus, King of Sweden, who was killed at the battle of Lutzen, November 6, 1632; and Albert Von Wallenstein, who led the imperial forces against Gustavus, and was assassinated in 1634. GEO. SHANER.

798. Who were the five greatest generals of modern times?

Ans.—Prince Eugene, who gained the battles of Peterwardein (1716) and Belgrade (1717), Wellington, Napoleon. Marlborough, and Frederic the Great.

GEO. L. SHANER.

I would consider Napoleon Bonaparte, the Duke of Wellington, George Washington, Frederick the Great, and Von Moltke the greatest generals of modern times.

J. H. W. SCHMIDT.

799. What writer was called *the tree of life*?

J. H. W.

Ans.—John Wallis, a Franciscan monk, was called the tree of life. He wrote before Chaucer's time.

PROPOSER.

800. What country is called the *Land of Health*?

Ans.—Badajoz, the capital of the Spanish province of Estramaduro, is called the "Land of Health."

PROPOSER.

801. What was Alfred's Jewel?

Ans.—One of the oldest and most celebrated badges in existence is the so-called jewel of King Alfred. It is an ornament of gold, apparently intended to hang around the neck, found in Athelney, and now in the Ashmolean Museum, Oxford. The inscription on one side, around a female figure holding flowers, is "Aelfred me habt gewercan" Alfred had me wrought. On the other side is a flower.

PROPOSER.

802. What was "the Eagle of the doctors of France"?

Ans.—Pierre d' Ailly (1350-1420), a French cardinal and great astrologer, who calculated the horoscope of our Lord and maintained that the stars foretold the great deluge, was called the "Eagle of the doctors of France." He presided at one of the sessions of the famous Council of Constance, in which John Huss was condemned to the stake. Yet he was a reformer, and boldly denounced the impurities of the church.

EDITOR.

803. Was Christmas-day ever abolished by Parliament?

Ans.—The following is from the *Flying Eagle*, a small gazette published December 24, 1653. "The House spent much time this day about the business of the navy, for settling the affairs at sea, and before they rose were presented with a terrible remonstrance against Christmas day, grounded upon divine Scriptures, 2 Cor. V., 16; 1 Cor. XV., 14, 17; and in honor of the Lord's Day, grounded upon these Scriptures, John XX., 1; Rev. I., 10; Psalms CXVIII., 24; Lev. XXIII., 7, 11; Mark XV., 8; Psalms. LXXXIV., 10; in which Christmas is Anti-christ's masse, and those Masse-mongers and Papists who observe it, etc.

In consequence of which Parliament spent some time in consultation about the abolition of Christmas day, passed orders to that effect, and resolved to sit on the following day, which was commonly called Christmas day. PROPOSER.

804. Name the old man who rang the Liberty Bell, July 4, '76.

ANS.—It is not known who rang the bell on that memorable occasion.

EDITOR.

805. What Senator was dismissed after 2 months service? Why?

ANS.—Albert Gallatin, a Swiss born, was elected from Pennsylvania, served two months, and dismissed, because he had not lived in U. S. the nine years required by the Constitution.

JOHN FITZGERALD.

806. What is there now to commemorate the spot where Washington took the oath, as first President?

W.

ANS.—The oath of office was administered to Washington by Chancellor Livingston, of New York, on the balcony of the old City Hall, on the present site of the Custom-House, in Wall Street.

J. H. W. SCHMIDT.

807. Give place and incidents of the first meeting or organization of the Society of American Foreign Missions.

ANS.—In the year 1806 five men, who were in the habit of resorting to the shade of certain trees for prayer at a stated time, were one day driven by the rain to the shelter of a hay stack. Here they formed the resolution of going as missionaries to heathen lands. Before the project was carried into execution one died, one from some cause failed to go, and three went. Such was the origin of American Foreign Missions, which has since grown to such large proportions. On the site of the hay stack which afforded them shelter has been erected a beautiful monument. On its summit is a large globe on which is engraved a map of the world. Below this is carved the inscription, "The field is the world;" "The birthplace of foreign missions." About the center is engraved a hay stack. Beneath this are the five names, Samuel J. Mills, James Richards, Francis L. Robbins, Harry Loomis, Byram Green. This memorable meeting took place at Williamstown, Mass., north of the college grounds, and close to the house occupied by Mark Hopkins, ex-president of Williams College. It is one of the places of interest to visitors to Williamstown. The place is circularly inclosed within a dense hedge of cedar and spruce, the monument being in the center, the inclosed space being large enough to drive around within it conveniently.

H. A. Wood.

808. What was engraved upon the memorial window presented to Williams College by Cyrus W. Field, in honor of James B. Garfield?

ANS.—"James Bryham Garfield, twentieth President of the United States, born Nov. 19, 1831, died September 19, 1881. In memory of his services to the country as scholar, soldier, and statesman, and in token of the universal love and sympathy called forth by his protracted suffering and untimely death, this window is placed in the chapel of his alma mater by his friend, Cyrus W. Field." The glass composing this window looks like pearl, and is composed of many pieces and colors. It represents Moses, with extended hand, viewing the promised land. It is said to have cost about four thousand dollars. The longer I looked at it the more I admired it.

H. A. Wood.

809. What political names are given to the U. S. Flag, and why so given?

L. M. O.

ANS.—We do not fully understand what the querist means, but our *National Colors*, *Stars and stripes*, *Star-Spangled Banner*, *Starry Banner*, *Freedom's Banner*, and our *National Standard*, are some of the names given to the American flag.

EDITOR.

810. Who is the author of the oft-repeated expression "and still they come"?

Ans.—In Shakespear's *Macbeth*, 5th scene of Act V., the expression, *The cry is still, "They come!"* is found, whence the saying is supposed to come. EDITOR.

811. Where are the richest deposits of salt and alum in the U. S.?

Ans.—In Socorro county, New Mexico, large deposits of natural alum have been found. There are at one place cliffs of alum 700 ft. high. In the Genesee and Mohawk valleys, New York, salt is most abundantly produced. EDITOR.

812. What U. S. Senators were known as "Miss Nancy" and "The Ohio Gong"? Why?

Ans.—William R. King, Senator from Alabama and Vice President under Pierce, was called "Miss Nancy" by his brother senators, on account of the fastidious attention he bestowed on his dress, and William Allen, on account of his loud voice, received the title of "The Ohio Gong." GEO. L. SHANER.

813. Is the ostrich egg the largest among birds' eggs?

Ans.—About four centuries ago Madagascar was the home of a bird, known as the *Aepyornis*, of the family *Struthide*, whose eggs are still found in a sub-fossil state, and are the largest known, being $12\frac{1}{4}$ inches by $9\frac{1}{2}$, and about eight times as large as the ostrich egg. Not long ago one of these eggs was offered to a museum of Natural history for \$3,000. Its capacity is over two gallons. This bird is extinct, but its remains are still found. EDITOR.

814. Robert R. Livingstone was one of the five men who drafted the Declaration of Independence. Why does he not appear as a signer of that immortal document? J. S. H.

Ans.—Mr. Livingstone's biographers are silent in regard to the reasons, but Lossing in his *Signers of the Declaration*, ventures the opinion that "Mr. Livingstone regarded as correct the doctrine that the representative is bound to act in accordance with the expressed will of his constituents. The Provincial Assembly of New York withheld all sanction of so strong a measure, at the time the Declaration was acted upon, and he considered it improper to take the responsibility of concurring in such an important measure, without the sanction of his constituents." But that sanction was given by the New York Assembly July 12, and as the Declaration was not signed till Aug. 2, we can see no reason why Mr. Livingstone should not have signed it then. John Hancock was the only signer July 4. Lossing is good authority, however, and his opinion above expressed is all that can be given. EDITOR.

815. Is there a property or an educational qualification for voting in any state of the Union?

Ann.—Delaware and Rhode Island allow only actual tax-paying citizens to vote. In several states women are permitted to vote on school questions.

JOHN FITZGERALD.

816. What principles does the order of Cincinnati advocate?

Ans.—The order of Cincinnati has three principles: 1st, An incessant attention to preserve inviolate those exalted rights and national liberties for which they fought and bled; 2d, An unalterable determination to perpetuate and cherish the union of the respective states and the honor of the American nation; 3d, To render permanent the cordial affections subsisting among the members and to extend substantial acts of beneficence toward unfortunate officers and their families.

MYRTLE GEORGE.

☞ All the queries are answered, and much valuable matter is here given.

CREDITS.

- B. F. FINKEL, *N. Lewisburg, O.*, 784, 190, 791, 795.
 MATTIE HARLEMAN, *Gordon, O.*, 784.
 U. H. DANIELS, *Gratz, Pa.*, 784, 785, 787, 795.
 J. H. W. SCHMIDT, *Ansonia, O.*, 784, 786, 795, 797, 802.
 JOHN FITZGERALD, *Greenville, O.*, 785, 794, 816.
 ED. RYNEABSON, *Gettysburg, O.*, 785, 791, 794.
 MYRTLE GEORGE, " " 785, 791, 795.
 CHAS. CHAVIS, *Spartansburg, Ind.*, 795, 786.
 WARREN LOY, *Pymont, O.*, 795, 911.
 GEO. L. SHANER, *Stewarts Station, Pa.*, 796.

QUERIES.

835. What became of the sacred vessels in Solomon's temple? W.
 836. When was the first anti-slavery society founded in U.S.? I.
 837. What king of France died of starvation? W.
 838. Give sketch of the "Maid of Saragossa." I.
 839. What garrison once surrendered to a dead man? W.
 840. Is there a lake of solid ice in the U. S.? If so, where? I.
 841. What and where are the "Shades of Death"? I.
 842. In Trinity Church Yard, N. Y., is an inscription, "Died, Feb. 19, 1738." What does § mean? W.
 843. What poetess has been styled the "Byron of her sex"? W.
 844. Where and by whom was the first university founded in Germany? W.
 845. Who is the acknowledged "King of Fashion"? R.
 846. What is known as the era of the "Great Schism"? W.
 847. What circumstances influenced Conrad to spare Weinsburg, after he had threatened to destroy it? W.
 848. Who was known as L' Petit Corporal"? S.
 849. Was the United States ever out of debt? S.
 850. What state voted for Filmore in 1856? MATTIE HARLEMAN?
 851. Why will the body of a drowned person come to the surface of the water after a time, and why will the firing of a cannon sometimes bring it to the surface? CURIOUS.
 852. Describe the purchase of Rhode Island. Id.
 853. Give author of *A little more grape, Capt. Bragg*. ANNIE.
 854. If a hair is extracted, will another grow in its place? ALBION.
 855. What were the last words of Jas. A. Garfield? B. F. F.
 856. What county in the Union is circular in form? M. G.
 857. What causes the high tides in the bay of Fundy? S. A.
 858. What is murratic acid, and how made? Id.
 859. Does size of brain determine the power of intellect? Id.
 860. How do divers work under water? Id.
 861. What was the "War of the Meal-sacks"? B. D.
 862. What is meant by *showing the white feather*? Id.
 What are known as *The Seven Mortal Sins? The Seven Virtues? The Seven Bodies in Alchemy? The Seven-Hilled City?* Id.

Answers should be received on or before Feb. 13.



EDITED BY

JOHN S. ROYER.

VOL. VII.

FEBRUARY, 1886

No. 2.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

825. If a solid globe of glass one foot in diameter be blown into a hollow sphere $\frac{1}{8}$ of an inch in thickness, what will be its diameter? SUBSCRIBER.

By A. M. SCRIPTURE, Clinton, N. Y.

Volume of ball is $12^3 \times \frac{1}{6}\pi$. Let x = diameter inside of crust; then $x + \frac{1}{4}$ is the diameter required. Now, $\frac{1}{6}\pi(x + \frac{1}{4})^3 - \frac{1}{6}\pi x^3 = 12^3 \times \frac{1}{6}\pi$. Dividing this equation by $\frac{1}{6}\pi$, we have $(x + \frac{1}{4})^3 - x^3 = 12^3$ or $x^3 + \frac{3}{4}x^2 + \frac{3}{16}x + \frac{1}{64} - x^3 = 1728$, or $48x^2 + 12x = 110591$, whence $x = 47.874$, and $x + \frac{1}{4} = 48.124$ inches.

By J. C. GREGG, Brazil, Ind.

Let $a = 6$ in., radius of solid globe, b = outer radius of hollow sphere and c the inner radius. Then $b^3 - c^3 = a^3 = 216 \dots (1)$, and $b - c = \frac{1}{8} \dots (2)$. Dividing (1) by (2), we have $b^2 + bc + c^2 = 1728 \dots (3)$. Squaring (2), gives $b^2 - 2bc + c^2 = \frac{1}{16} \dots (4)$. From (3) and (4), $bc = 575\frac{1}{8} \dots (5)$, and $4bc = 2303\frac{1}{2} \dots (6)$. From (4) and (6) $(b+c)^2 = 2303\frac{1}{2} \dots (7)$, and we have

$$b + c = 47.999$$

$$b - c = .125$$

$$2b = 48.124 \text{ inches, the required diameter.}$$

By S. G. CAGWIN, New London, N. Y.

Put $a = \frac{1}{8}$, D = inside diameter of hollow sphere, $D + 2a$ = its outside diameter and d = diameter of solid globe. Then

$$\frac{1}{6}\pi(D + 2a)^3 - \frac{1}{6}\pi D^3 = \frac{1}{6}\pi d^3 \dots (1)$$

Dividing by $\frac{1}{6}\pi$, expanding and arranging terms,

$$D^3 + 2aD = (d^3 - 8a^3) \div 6a \dots (2)$$

Whence $D = -a \pm \sqrt{(d^3 - 8a^3) \div 6a + a^2} = 48\frac{1}{8}$ inches, nearly.

826. Suppose the market value of 5% bank stock to be $11\frac{1}{9}\%$ higher than 8% corporation bonds. I realize 8% on my investment and my income from each is \$180; what did I invest in each?

AARON MOUL.

By S. S. MILLER, Bradford, Ohio.

The face value of bank stock is $\$180 \div .05 = \3600 , and that of corporation bonds, $\$180 \div .08 = \2250 ; his income being \$360, he invested $\$360 \div .08 = \4500 . Had the stock been the same in market as the bonds, he would have invested $11\frac{1}{9}\%$ of $\$3600 = \400 less, or $\$4500 - \$400 = \$4100$. Suppose now that he invested 100% of face value of stock, then he would also invest face value of the bonds, or $\$2250 + \$3600 = \$5850$; but we found by the hypothesis that he invested \$4100; hence he bought at a discount, and paid $4100 \times 100 \div 5850 = 70\frac{10}{17}\%$, or $\$2250 \times 70\frac{10}{17} = \$1576.92\frac{1}{3}$ for corporation, and $70\frac{10}{17} + 11\frac{1}{9} = 81\frac{23}{17}\%$, or $\$3600 \times 81\frac{23}{17} = \$2923.97\frac{1}{3}$ for stock.

By J. R. BALDWIN, Blue Grass, Iowa

We have $\$180 \div .05 = \3600 , the par value of bank stock, $\$180 \div .08 = \2250 , par value of corporation stock, and $\$360 \div .08 = \4500 , his entire investment. Let $\frac{1}{10}x =$ market value of corporation; then $\frac{1}{10}x + \frac{1}{9} =$ market value of bank stock, and we have

$$(\frac{1}{10}x + \frac{1}{9})3600 + \frac{2}{10}x = 4500.$$

whence $x = 70\frac{10}{17}\%$ and $x + 11\frac{1}{9} = 81\frac{23}{17}\%$. Therefore $\$3600 \times 81\frac{23}{17} = \$2923.97\frac{1}{3}$ is the investment in the former and $\$2250 \times 70\frac{10}{17} = \$1576.92\frac{1}{3}$ in the latter.

The word *higher* indicates that rate of stock is $11\frac{1}{9}\%$ more than the rate of the bonds, and the above solutions are correct. Most of our contributors solved it as a similar problem, p. 230, (5th) Ray's Higher Arithmetic is solved.

827. It is frequently remarked as very singular that those 8 months of the year which contain an *r* should all occur in sequence. How singular is it computed by the rule of combinations?

By WM. WILEY, Detroit, Mich.

If there were no circumstances that induced one of these months to follow another, we should seek the combinations of 8, or 4 each in 12, and find $(9 \times 10 \times 11 \times 12) \div (1 \times 2 \times 3 \times 4) = 495$, and the chance would be 1 in 495. But Sept., Oct., Nov. and Dec. are numeral months and must go together. Also, Jan. and Feb. have the same termination, and naturally belong together. Thus we have only 8 movables, and in order to have 4 combinations together having no *r*, we must take the combinations of 4 each in 8, and shall find $(5 \times 6 \times 7 \times 8) \div (1 \times 2 \times 3 \times 4) = 70$, and the chance is 1 in 70.

828. Dudley bought 5% railroad stock at $109\frac{1}{2}\%$ and $4\frac{1}{2}\%$ pike stock at $107\frac{1}{2}\%$, brokerage $\frac{1}{2}\%$; the former cost him $\$100$ less than the latter, but yielded the same income. What did each cost him?

C. R. GEORGE.

By GEO. C. RUSSELL, *San Francisco, Cal.*

He realizes $5 \div 1.10 = 4\frac{5}{11}\%$ on investment in R. R. stock, and $4\frac{1}{2} \div 1.08 = 4\frac{1}{8}\%$ on investment in pike stock. Since they yielded the same income, the costs are inversely as $4\frac{5}{11}\%$ and $4\frac{1}{8}\%$, or as 11 to 12; the difference is $1 = \$100$, and the former cost $\$1100$ and the latter $\$1200$.

By D. W. K. MARTIN, *Versailles*, and G. W. LEAHY, *Marshallville, O.*

Railroad costs $109\frac{1}{2} + \frac{1}{2} = 110\%$, and $107\frac{1}{2} + \frac{1}{2} = 108\%$ is the cost of pike stock. Now, 5% on face is $\frac{5}{110} = \frac{1}{22}$ of the investment, and $4\frac{1}{2}\%$ on face is likewise $\frac{1}{24}$ of investment. Since both yielded same income, $\frac{1}{22}$ of cost of railroad stock is $\frac{1}{24}$ of the cost of the pike stock, and $\frac{2}{3}$ of the cost of the former is $22 \times \frac{1}{24} = \frac{11}{6}$ of the cost of the latter. Then the difference is $\frac{1}{6} = \$100$, and $\frac{11}{6}$ or cost of pike stock is $\$1200$, and $\frac{11}{6}$ or cost of railroad stock is $\$1100$.

829. How many tucks $\frac{1}{4}$ of an inch in width can a lady make in a strip of muslin one yard wide, leaving $\frac{1}{4}$ of an inch between the edge of one tuck and the stitching of the next?

S. S. MILLER.

By J. E. GENSEMER, WM. KAUFMAN, AND R. A. LEISKY,
Marshallville, Ohio.

It is evident that the tuck contains a triple thickness of the goods and requires $2\frac{1}{4}$ in., to which add $\frac{1}{4}$ of an inch for margin, and get $2\frac{1}{4} + \frac{1}{4} = 2\frac{3}{4}$ in. the width required for each tuck; hence $36 \div 2\frac{3}{4} = 15$ tucks and $\frac{3}{4}$ of $\frac{1}{4} = \frac{3}{16}$ of an inch of muslin to spare.

NOTE. The problem had the tucks $\frac{1}{2}$ of an inch, instead of $\frac{1}{4}$ which was a misprint. If you take $\frac{1}{2}$ there will be 41 tucks and the margin of $\frac{1}{4}$ of an inch left along the last tuck.

830. I sold two buggies for the same sum; on one I gained 30% and on the other I lost 50% . What did each cost me, if my loss was $\$24$ in the sale?

GEO. M. MORRIS.

By T. L. BREWER, *Mt. Heron, Ohio.*

Let $100\% =$ cost price of first buggy; then $130\% =$ selling price of each, and $130 \div .50 = 260\% =$ cost of second. Both cost $100 + 260 = 360\%$, and were sold for $130 \times 2 = 260\%$; hence the loss is $360 - 260 = 100\% = \$24$, which is the cost of first, and 260% of $\$24 = \62.40 , cost of second.

831. Two ladders stand on a plane with their bases 20 feet apart and their tops forming an angle of 45° where they touch. Find the length of each ladder.

By J. W. PFEIFFER, *Philo, Ohio.*

Let $AB = AC$ be the length of the ladders. Draw AD to D , the middle point of the line BC , and it will be perpendicular to this line. On AD take $ED = DB = 10$ feet. Angle $DBE = 45^\circ$ and since angle $B = 67\frac{1}{2}^\circ$, the angle $EBA = 22\frac{1}{2}^\circ$; but angle $EAB = 22\frac{1}{2}^\circ$, hence triangle EAB is isosceles, and $EA = EB$. $EB = 10\sqrt{2}$; $AD = 10 + 10\sqrt{2}$: hence the line AB is $\sqrt{[(10 + 10\sqrt{2})^2 + 10^2]} = 26.131259297525$ ft.



By JOHN C. GREGG, *A. M., Brazil, Ind.*

Let OM and OL^* be the ladders, and let us suppose four sets of ladders similarly placed about the point O ; they will form the octagon $EFGHKL MN$. Then $LK = ML = HK = 20$, and $CK = \sqrt{(20^2 + 20^2)} = 10\sqrt{2}$ and $CP = 10 + 10\sqrt{2}$; but $OP = CP = 10(1 + \sqrt{2})$. Hence $OL = OK = \sqrt{(OP^2 + OK^2)} = \sqrt{(400 + 200\sqrt{2})} = 26.131$ ft.

832. A sphere and a cube have a common center. If the edge of cube is 5 inches and the diameter of sphere 7 inches, what is the volume of the cube within the sphere?

EDITOR.

By HENRY GUNDER, *New Castle, Ind.*

Each side of the cube cuts off a spherical segment of one base, whose height is $(7 - 5) \div 2 = 1$ inch. The volume of one of these segments is $\frac{3}{8}\pi$, as found by the following rule; From three times the diameter of the sphere subtract twice the height of the segment, multiply by the square of the height, and that product by $\frac{1}{6}\pi = 5236$. Since there are 6 such segments, the entire volume cut off is 19π . Volume of sphere is $\frac{4}{3}\pi(3\frac{1}{2})^3 = 57\frac{1}{6}\pi$. Hence the volume common to sphere and cube is $57\frac{1}{6}\pi - 19\pi = 38\frac{1}{6}\pi = 119.9$ cu. in.

833. A square and its circumscribing circle revolve about the diagonal of the square as an axis. Find the volumes and surfaces thus generated by the square and circle respectively.

ED.

By D. W. K. MARTIN, *Versailles, Ohio.*

Let d = diagonal of square = diameter of circle. The square generates two equal cones, base to base, and the circle, a sphere. Diameter of each cone is d , altitude $\frac{1}{2}d$, slant height $\sqrt{(d^2 \div 2)} = \frac{1}{2}d\sqrt{2}$, and curved surface of both is $\frac{1}{2}\pi d \times \frac{1}{2}d\sqrt{2} \times 2 = \frac{1}{2}\pi d^2\sqrt{2}$. Their volume is $(d^2 \times \frac{1}{3} \times \frac{1}{2}d \div 3) \times 2 = \frac{1}{9}\pi d^3$. Surface of sphere is πd^2 and its volume, $\frac{1}{6}\pi d^3$.

* Figure on p. 209, Vol. 4, No. 11, in solution of Prob, 519.

834. A circle within another touches it at a point A , and the lune thus formed is 3 times the small circle. Now, how many revolutions will the smaller circle make if rolled on the circumference until it reaches again the original position on the point A .

JAS. SMITH.

By A. L. FOOTE, Hempstead, N. Y.

Since the lune outside the smaller circle is 3 times the smaller circle, then the whole of the large circle is 4 times the small circle, and consequently its circumference is twice that of the small circle. Hence in rolling on the circumference till it comes to the same position again, it has every part of its circumference twice in contact with that of the larger circle, and if rolling on a straight line would make two revolutions, but rolling on the inside of the circumference of larger circle, it makes but *one* revolution.

835. A door weighing 30 lb. is 8 feet long and 4 feet wide, and supported by two hinges with centers one foot from the top and bottom, respectively. Find the vertical and horizontal pressure on each hinge.

Id.

By HENRY GUNDER, New Castle, Ind.

Let the origin of co-ordinates be taken at the lower hinge A , and let $x=a=2$, $y=b=3$, be the co-ordinates of g , the center of gravity of the door. Then $x=0$, and $y=h=6$ will be the co-ordinates of the upper hinge B . Let the resolved pressure at B be q horizontally, and r vertically, and those at A be q' and r' , respectively.

Then, since there is equilibrium, we must have $q'-q=0 \dots (1)$ and $q'=q$. Again, $30=w=r+r' \dots (2)$. Also, $wa-qh=0$, or $q=wa \div h \dots (3)$. That is, the pressure on the hinges horizontally are equal and opposite; but the pressures on the hinges vertically, being expressed by (2), are indeterminate, their sum equals the weight of door. Supplying numbers in (3), we have $q=10$ lb.

836. What rate per cent of income shall I receive, if I buy U. S. 5's at a premium of 10% and receive payment at par in 15 years?

ROBINSON.

By J. C. CORBIN, Pine Bluff, Ark.

At the end of 15 years, I receive $15 \times 5 = 75$ dollars interest, and lose \$10 premium; so that \$65 is the result of the two operations, which is $65 \div 15 = \$4\frac{1}{3}$ income per year on \$110; hence $4\frac{1}{3} \times 100 \div 110 = 3\frac{3}{4}\%$ is the rate.

By J. R. BALDWIN, Blue Grass, Iowa.

The cost of \$1 of stock is \$1.10, which, in 15 yr. at 5%, amounts to \$1.75, and my entire income is $\$1.75 - \$1.10 = \$.65$; $\therefore$ the rate is $.65 \div 1.10 = 59\frac{1}{11}\%$.

837. A tumbler in the form of a conic frustum, is 4 inches in diameter at the top, 3 inches at the bottom, and 4 inches deep. A metal ball $3\frac{1}{2}$ inches in diameter is placed in the tumbler which was full of water. What per cent of the water will overflow?

N. B. WEBSTER.

By GEORGE G. BROWER, *Lee Center, N. Y.*

Solid contents of tumbler is $\frac{1}{3}$ of $4\pi[2^2+1.5^2+\frac{1}{2}(2 \times 1.5)] = 12\frac{1}{3}\pi$, and that of ball is $(3\frac{1}{2})^3 \times \frac{1}{6}\pi = \frac{343}{8}\pi$. It is found by geometry that the ball is immersed, hence an equal volume of water will overflow, and $\frac{343}{8}\pi \times 100 \div 12\frac{1}{3}\pi = 57\frac{139}{48}\%$

838. A and B start from a town at the same time for the same point; it takes A 10 hours to reach the point, and B travels 5 times as fast going, and 10 times as fast returning, as A; when and how far from the town do they meet?

D. W. K. MARTIN.

By B. F. FINKEL, *North Lewisburg, Ohio.*

While B travels to the post, A travels $\frac{1}{5}$ of the distance. Then A must travel $\frac{4}{5}$ to go to the post, but while he gradually advances he meets B returning. Let $\frac{1}{10} =$ distance B travels in returning till he meets A, and $\frac{1}{10} =$ distance A travels in advancing. Now, $\frac{1}{10} + \frac{1}{10} = \frac{1}{5}$ is the distance both travel or $\frac{4}{5}$; $\therefore \frac{1}{10} = \frac{4}{5}$, $\frac{1}{10} = \frac{4}{5}$, the part of the distance A travels, and $\frac{4}{5} + \frac{1}{5} = \frac{5}{5}$ of the distance from town to the post is where they meet. Since A can travel to the post in 10 hours, he can travel $\frac{3}{5}$ of the distance in $\frac{3}{5}$ of 10 hr. = $2\frac{2}{5}$ hr.

839. What are the sides of an equilateral spherical triangle whose area is $\frac{1}{8}$ surface of sphere?

WM. WILEY.

By HENRY GUNDER, *New Castle, Ind.*

Let $\theta =$ circular measure of each angle. Then $(3\theta - \pi) \div \frac{1}{2}\pi = \frac{1}{8}\pi$ area. $\therefore \theta = \frac{5}{8}\pi$ or 140° . To find the sides we have, letting $x =$ each side, $\cos \frac{1}{2}x = \sqrt{\frac{1}{2}[\cos^2(s - \theta)] \div \sin^2 \theta} = \cos \frac{1}{2}\theta \div \sin \theta = 1 \div 2 \sin \frac{1}{2}\theta = \frac{1}{2} \operatorname{cosec} 70^\circ$. Hence $x = 115^\circ 42' 26''$.

J. R. BALDWIN, *Blue Grass, Iowa.*

Let $T =$ the tri-rectangular triangle, $A =$ each of the angles of the given triangle, and $R =$ radius of sphere. The surface of sphere = $8T$ and the surface of given triangle $\frac{8}{3}T$. We have the RULE.—*The area of a spherical triangle is measured by the excess of the sum of its three angles above two right angles, multiplied by the tri-rectangular triangle.*

Hence $(3A - 2)T = \frac{8}{3}T$, whence $A = 1\frac{2}{3}$ right angles, or 140° . Each side of the given triangle is the arc of a great circle, measured by 140° , and is $\frac{1}{8}$ of a great circle, or $\frac{1}{8}$ of $2R\pi = \frac{1}{4}R\pi$.

840. The side of a square is 100 feet. What is a side and area of its inscribed equilateral triangle? H. A. WOOD.

By WILLIAM WILEY, *Detroit, Mich.*

Let the sides of the square be unity. Draw a diagonal which will be $\sqrt{2}$. Let the base of the equilateral triangle be perpendicular to the diagonal, and let its distance from the corner of the square be x . Then we have a right-angled triangle, whose base is x and its altitude is $\sqrt{2}-x$. Hence $x \div (\sqrt{2}-x)$ is tangent of $30^\circ = 1 \div \sqrt{3}$. Hence $x\sqrt{3} = \sqrt{2}-x$, or $x(1+\sqrt{3}) = \sqrt{2}$, and $x = \sqrt{2} \div (1+\sqrt{3})$, which makes the side $2\sqrt{2} \div (1+\sqrt{3})$, and since the side of square is 100, the required side is $100[2\sqrt{2} \div (1+\sqrt{3})] = 103.5276$ feet. The area is $[2\sqrt{2} \div (1+\sqrt{3})]^2 \times \frac{1}{4}\sqrt{3} \div (2+\sqrt{3}) = 2\sqrt{3}-3$; and $10000(2\sqrt{2}-3) = 4641.016$ sq. ft.

841. "What two whole numbers are those, the sum of whose squares multiplied by the greater is equal to 1305, and the difference of whose squares multiplied by their product is equal to 1224." MARCELLUS M. THOMPSON.

By J. W. PFEIFFER, *Bolivar, Ohio.*

Let x = the greater, and y = the less. $x(x^2+y^2) = 1305 \dots (1)$, and $xy(x^2-y^2) = 1224 \dots (2)$. Dividing (1) by (2), and then placing numerators and denominators equal to each other, we have $x^2+y^2 = 145 \dots (3)$, and $y(x^2-y^2) = 136 \dots (4)$. Multiplying (3) by y , subtracting from (4), we have $2y^3 = 145y - 136 \dots (5)$. Multiplying (5) by $8y$ and then subtracting $136y^2$ from both sides, we have $16y^4 - 136y^2 = 1024y^2 - 1088y$. Adding 289 to both sides, and extracting square root, $4y^2 - 17 = \pm(32y - 17)$; whence $y = 8$, and $x = 9$.

CREDITS.

- S. S. MILLER, *Bradford, O.*, 838.
 CLINTON LONG, *Versailles, O.*, 838.
 T. L. BREWER, *Mt. Heron, O.*, 825, 830, 831.
 D. W. K. MARTIN, *Versailles, O.*, 826, 828, 829, 830, 831, 833, 834, 840.
 ANNA BANKERD, *West Sonora, O.*, 826.
 J. C. GREGG, *Brazil, Ind.*, 825, 826, 828, 830, 831, 833, 834, 835, 840.
 A. M. SCRIPTURE, *Clinton, N. Y.*, 825, 829, 830, 831, 732, 833, 834, 837, 838, 840.
 J. W. KECKLER, *Hagerman, O.*, 828, 829, 830, 831.
 S. G. CAGWIN, *New London, O.*, 792, 796, 798, 802, 803, 804, 805, 806, 817, 825, 830, 831, 834, 837, 839, 842, 843.
 HARRY GILBERT, *Gettysburg, O.*, 826, 829, 831.
 WM. WILEY, *Detroit, Mich.*, 825, 829, 830, 831, 832, 833, 834, 838, 839, 840.
 R. A. LEISY, *Marshallville, O.*, 825, 826, 828, 829, 830, 831, 832, 837, 838, 840.
 GEO. W. LEAHY, " " 825, 826, 828, 829, 830, 831, 832, 833, 834, 837, 838.
 J. E. GESSEMER, " " 828, 829, 830, 831, 837.
 WM. KAUFFMAN, " " 829, 830, 837, 838.
 B. F. FINKEL, *North Lewisburg, O.*, 803, 804, 806, 825, 826, 828, 830, 834, 838.
 GEO. C. RUSSELL, *San Francisco, Cal.*, 825, 826, 827, 828, 829, 830, 831, 834, 836, 838, 839.

A. L. FOOTE, *Merrick, N. Y.*, 825, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 840, 841.

HENRY GUNDER, *New Castle, Ind.*, 825, 831, 832, 833, 834, 835, 837, 838, 839, 840, 841.

J. C. CORBIN, *Pine Bluff, Ark.*, 825, 828, 829, 830, 831, 832, 833, 834, 836, 837, 838, 839, 840, 841.

J. R. BALDWIN, *Blue Grass, Iowa*, 825, 826, 828, 829, 830, 831, 833, 835, 836, 837, 838, 840.

GEO. G. BROWER, *Lee Center, N. Y.*, 825, 826, 828, 830, 831, 833, 834, 837, 838.

J. W. PREIFFER, *Bolivar, O.*, 825, 826, 828, 829, 830, 831, 833, 834, 837, 838, 840, 841.

Problems for Solution.

856. I have a certain number of 3-inch cubes which exactly fill three cubical boxes. The first box contains 217 more than the second, and the second 169 more than the third. How many cubes and what is the size of the boxes?

EDITOR.

857. A, B and C mow a field for \$12. A mows as much as B and C, lacking 5 acres, and B as much as A and C, lacking 10 acres. If A receives \$5, how much should B and C receive?

Id.

858. A dealer bought corn at 60 cents, potatoes at 30 cents, and oats at 40 cents per bushel, and pays for all \$1300. He sells $\frac{2}{3}$ of the corn at a gain of 25%, and half the potatoes at an advance of 33 $\frac{1}{3}$ %, gaining twice as much on the corn as on the potatoes, and on the sale $\frac{2}{3}$ as much as the oats cost. How many bushels of each did he buy?

Id.

859. Suppose half-sheets of foolscap paper, a foot long, were pasted together at ends, and 25 lines of figures, and 40 figures to the line, were written thereon, how long a strip of paper would be required to hold the number indicated by 4?

Id.

860. A board in the shape of a trapezoid, is to be divided into two equal parts by sawing it across parallel to the ends. It is 15 feet long, 17 in. wide at one end and 7 in. wide at the other.

JAMES SMITH.

861. A, B and C bought a grindstone 3 feet in diameter and 3 inches thick for \$5; A paid \$2, B, \$1.75 and C, \$1.25. How many inches must each grind off so that he may have the worth of his money; A grinding first, B next, and then C, no allowance being made for loss or wastage.

ROYERS PROBLEMS.

862. How many cannon balls 4, 6, or 9 inches in diameter, can be placed in a cubical vessel, 3 feet on a side; and how many gallons of wine will it contain after it is filled with the balls?

G. L. SHANER.

863. Paid \$180 for a claim due in six months. A broker bought it on the same day, taking bank discount at 6%. If I cleared \$13.90, what was the amount of the claim?

P. C. PALMER.

864. A man walks around a circle with a flag-staff 10 feet long in his hand. If the staff lean out from the vertical 30°, how much farther will the top move than the bottom of the staff in going one round.

Id.

865. An agent gets 25 and 5% for cash and 23% for notes on machine sales, and 33 $\frac{1}{3}$ % on repairs sold for cash. After selling repairs listed at \$15 for cash and machinery listed at \$150, part for cash and part notes, finds that the notes received will balance his account with the company, leaving all the cash for his commission. What was the value of the notes?

ALEX. KNISELY.

866. Four ladies bought a ball of fine thread 3 inches in diameter; what portion of the diameter must each wind off in order to have equal shares of the thread?

ROYER'S PROBLEMS.

Solutions should be received on or before March 20.

306. Find the integral right triangle whose area is 6 times the sum of its sides.

By HON. JOSIAH H. DRUMMOND, *Portland, Me.*

I was surprised to find that my solution does not give the particular triangle found by Prof. Corbin. I am, therefore, dissatisfied with my solution, and I submit the following.

Let x , y , and $\sqrt{x^2 + y^2}$ be the sides of the triangle; then we have $\frac{1}{2}xy = 6[x + y + \sqrt{x^2 + y^2}]$; take $x = my$ and reducing we have

$$y = 12[m + 1 + \sqrt{(m^2 + 1)}] \div m.$$

To make $m^2 + 1$ a square, assume $m^2 + 1 = (pm - 1)^2$. Then $m = 2p \div (p^2 - 1)$; by substitution, we find $y = 12(p + 1)$ and $x = 24p \div (p - 1)$; to make these integral numbers, it is evident that p may be any whole number, that diminished by one, is a factor of 24.

So take $p = 2, 3, 4, 5, 7, 9, 13, 25,$

and $y = 30, 48, 60, 72, 96, 120, 168, 312,$

$x = 48, 36, 32, 30, 28, 27, 26, 25.$

Also p may be any fractional number whose denominator is a factor of 12; when also 24 is divisible by $p - 1$. Taking such values, we get in most cases the values for y that we have already obtained for x , and *vice versa*. But $p = 1\frac{1}{2}$ gives $y = 33$, and $x = 56$, and $p = 2\frac{1}{2}$ gives $y = 42$, and $x = 40$. I thus get *nine* triangles answering the conditions of the question, and *no more*.

Editorial Notes.

The answers to the first set of questions in history, page 39, were furnished by John Fitzgerald, of Weavers, Ohio.

The March *Visitor* will be very interesting in all its departments. Our contributors have given us many good things, for which the editor and the reader are truly thankful.

N. B. Webster, the veteran educator and ripe scholar of Norfolk, Va., is now at Yonkers, N. Y., engaged in literary work. He will be a contributor to the miscellaneous department this year, and our friends can expect some valuable matter from his pen.

The Teachers' Association will meet at Arcasum, on Saturday, Feb. 27. We shall be glad to take subscriptions and see friends at that meeting. We desire to increase the circulation in the county, and our friends who aid in the work, shall have our hearty thanks.

Our biographical sketches of contributors published in December, were read with interest, and a call for more has been made. In May issue we propose to give a sketch of all who solve the eleven problems proposed on the preceding page. Of course those noticed before will not be repeated, but they can still solve all, as due credit will be given.

We thank the *Central Normal News*, published quarterly, at Danville, Ind., for a notice of our *Visitor* in the last issue. We reciprocate by stating that the Central Normal College is now giving strong inducements to those who desire to attend a Normal School. Write to the president, Mrs. F. P. Adams, Danville, Ind.

ENGLISH GRAMMAR.

Answers to Queries.

1. Give syntax of italicized words: *It is wicked to scoff* at religion.
J. A. ROACH.

Ans.—*It* is a personal pronoun, subject of *is*. *Is* is a copulative verb, taking the adjective *wicked* in the predicate. *To scoff* is an infinitive with the construction of an adverb, limiting *it*, as an appositive.

2. Parse—*To be good is to be kind*. I want *him* to be a scholar.
J. A. U.

Ans.—*Good* and *kind* are adjectives in the predicate with *to be*. *To be* is a copulative verb, construction of a noun, in the predicate with *is*.

Him is a pronoun, object of *want*. *Scholar* is a noun, in the objective case, in the predicate with *to be*, and should be called a predicate objective or objective complement of *want*. It is in the objective case, because *him* to which it relates is an objective.

3. Diagram—The teacher was too indulgent to succeed in school discipline.
JAS. SMITH.

teacher the	
was-indulgent too to succeed in discipline school	

4. The pupil is old enough to know better. Id.

pupil the	
is-old enough to know better	

5. The school is destined to become a great power for good. Id.

school the	
is destined—to become-power	a great for good

Here we have what some authors call the *strengthened copula*. *Power* is predicate nominative and *to become* is used as a predicate adjective.

6. I have no fears of that teacher's being too cross. Id.

I	
have fears	no of being-cross too teacher's that

Being Cross is a phrase, object of *of*, and modified by *teacher's*. *Cross* is an adjective, referring to *teacher*.

7. We wondered whether the saltiness of the Dead Sea was not Lot's wife in solution. Id.

we	(whether)	
wondered	saltiness the was-wife Lot's not in solution	of Dead Sea the

Examination Questions.

First set of questions was used Jan. 16, and second set, Feb. 6.

ARITHMETIC.

1. Two trees whose heights are 40 and 80 feet respectively, stand on opposite sides of a stream 30 feet wide. How far does a squirrel leap in jumping from the top of the higher to top of the lower?

Ans.—The squirrel would describe a parabola, the length of which can not be found by arithmetic. A straight line joining the tops of the two trees is the hypotenuse of a right-angled triangle whose base is 30 ft. and altitude 80—40, or 40 feet; hence the tops are $\sqrt{(30^2+40^2)}=50$ feet apart.

2. How many steps of 3 feet each does a man take in crossing a square field diagonally, that contains 20 acres?

Ans.—The area is $20 \times 160 = 3200$ sq. rd.; and the diagonal, $\sqrt{(3200 \times 2)} = 80$ rd., or 1320 ft. Hence he must take $1320 \div 3 = 440$ steps.

3. What must I ask for goods that cost \$4 a yard, that I may fall 20% and still make 20% profit?

Ans.—I must sell for $\$4 \times 1.20 = \4.80 , and ask $\$4.80 \div .80 = \6 .

4. A grocer buys coffee at 15 cents, to the amount of \$90, and sells it at the same price by Troy weight; find his per cent of gain or loss.

Ans.—He gains $7000 - 5760 = 1240$ gr. on each pound sold, and the rate is $1240 \times 100 \div 5760 = 21\frac{1}{3}\%$.

5. By annual interest, find the amount of a note of \$500 due in 4 years at $8\frac{1}{2}$ per cent.

Ans.—Interest on principal is $\$500 \times .34 = \170 ; interest on annual interest is $\$42.50 \times .08\frac{1}{2} \times (3 + 2 + 1) = \21.675 ; $\$500 + \$170 + \$21.675 = \691.675 .

6. Divide 1384.46 into 3 parts which shall be to each other as $\frac{1}{3}$, $\frac{3}{5}$, and $\frac{7}{8}$.

Ans.—The parts are to each other as 40, 72 and 105; $\therefore \frac{40}{217}$ of 1384.46 = 255.2 first; $\frac{72}{217}$ of 1384.46 = 459.36, second; $\frac{105}{217}$ of 1384.46 = 669.9, third.

7. A and B have just \$500; $\frac{3}{4}$ of A's money is \$50 less than $\frac{2}{3}$ of B's. What sum has each?

Ans.—If $\frac{3}{4}$ of B's is $\frac{3}{4}$ of A's + \$50, $\frac{1}{4}$ of B's is $\frac{1}{4}$ of ($\frac{3}{4}$ of A's + \$50) = $\frac{3}{8}$ of A's + \$25, and $\frac{3}{8}$ of B's is 3 times ($\frac{3}{8}$ of A's + \$25) = $\frac{9}{8}$ of A's + \$75, to which add $\frac{5}{8}$ of A's, and you have $\frac{14}{8}$ of A's + \$75 = \$500; from which $\frac{14}{8}$ of A's is \$425, and he has $\$425 \div \frac{14}{8} = \240 ; B has $\$500 - \$240 = \$260$.

8. Find the cost of paving a court 150 feet square; a walk 10 feet around the whole being paved with flag-stones at 54 cents a square yard and the rest at $31\frac{1}{2}$ cents a square yard?

Ans.—Area of walk is $2 \times (150 + 140) \times 10 = 5800$ sq. ft., and the paving costs $5800 \div 9 \times .58 = \348 ; the area covered by flag-stone is $130^2 = 16900$ sq. ft., and costs $16900 \div 9 \times 31\frac{1}{2} = \591.50 ; whole cost is $\$348 + \$591.50 = \$939.50$.

9. At 30 cents a bushel, find the cost of a box of oats, that is 8 feet long, 4 feet wide and 4 feet deep.

Ans.—It will cost $96 \times 48 \times 48 \div 2150.42 \times .30 = \$30.85\frac{1}{2}$.

10. $\frac{3}{4}$ of A's money is $\frac{2}{3}$ of B's, and $\frac{3}{4}$ of B's is $\frac{2}{3}$ of C's, which is \$81. How much have A and B each?

ANS.—We have $(\frac{2}{3} \text{ of } 81) \div \frac{3}{4} = 72$ B's; and $(\frac{2}{3} \text{ of } 72) \div \frac{3}{4} = 64$ A's.

1. Divide the square root of 25 ten thousandths by 5 ten thousandths.

ANS.—We have $\sqrt{.0025} = .05; .05 \div .0002 = 100$.

2. What is a multiple of a number?

ANS.—One or more times the number.

3. An estate was divided between two brothers and a sister; the elder brother received $\frac{2}{3}$ of the estate, the younger $\frac{1}{10}$, and the sister the remainder, which was \$500 less than the elder brother received. What was the value of the estate?

ANS.—The sister received $1 - (\frac{2}{3} + \frac{1}{10}) = \frac{7}{30}$; hence $\frac{2}{3} - \frac{1}{10} = \frac{17}{30} = \500 , and the estate is $\$500 \times 20 = \$10,000$.

4. A tailor has $67\frac{2}{3}$ yards of cloth, from which he wishes to cut an equal number of coats; pants, and vests. How many of each can he cut if they contain $3\frac{1}{4}$, $2\frac{1}{5}$, and $1\frac{1}{2}$ yards respectively?

ANS.—He can make $67\frac{2}{3} \div (3\frac{1}{4} + 2\frac{1}{5} + 1\frac{1}{2}) = 8$ suits.

5. B sold goods at 40% gain, investing the proceeds sold at 40% loss. Did he gain or lose by the operation, and what per cent?

ANS.—He received 140% for the first and $140 \times .60 = 84\%$ for second. Loss $100 - 84 = 16\%$.

6. Two trees stand on opposite sides of a stream 40 ft. wide. The height of one tree is to the width of the stream as 8 is to 4, and the width of the stream is to the height of the other as 4 is to 5. What is the distance between their tops?

ANS.—The one tree is $40 \times 2 = 80$ feet and the other $40 \times 1\frac{1}{4} = 50$ feet. A horizontal line from the top of lower to the higher is 40 ft. —base of a right-angled triangle whose perpendicular is $80 - 50 = 30$ feet; hence $\sqrt{(40^2 + 30^2)} = 50$ feet is the required distance.

7. When gold was worth 50% more than currency, what was the value in gold of a dollar bill?

ANS.—Let 100% = currency, 150% = gold, and $\$1.00 \div 1.50 = \$.66\frac{2}{3}$ is the value.

8. A horse tied to a stake can graze on $436\frac{1}{2}$ square yards of surface, to what distance from the stake can it graze?

ANS.—We have $\sqrt{(436\frac{1}{2} \div 3.1416)} = \frac{25}{2} \sqrt{2} = 11.785$ yards.

9. A and B buy 200 head of sheep for \$500. A pays \$300 and B \$200. Each keep 50 head, and they sell the remainder at \$4 a head. How should they divide the money?

ANS.—A owns $\frac{2}{5}$ of 200 = 120 and B $\frac{3}{5}$ of 200 = 80 sheep. A's portion sold are worth $70 \times 4 = \$280$, and B's, $30 \times 4 = \$120$.

10. A received \$60 and B \$22.50 from a joint speculation. If A invested \$25 more than B, what did each invest?

ANS.—A gains \$60 — \$22.50 = \$37.50 more than B. hence the investment is 25 : \$37.50 = $\frac{2}{3}$ of the gain, and A invested $\frac{2}{3}$ of \$60 = \$40 and B $\frac{1}{3}$ of \$22.50 = \$15.

GEOGRAPHY.

1. Name the eight principal planets in the order of their distances from the sun.

Ans.—Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.

2. What is the distance of the moon from the earth? Of the earth from the sun?

Ans.—About 240,000 miles. About 92,000,000 miles.

3. Is the earth farther from the sun in the summer than in the winter? Why is it warmer in summer than in winter?

Ans.—Yes, about 3,000,000 miles. Because the sun's rays are more vertical, and consequently more rays strike a given surface of the earth than in winter.

4. To what races do the inhabitants of the U. S. belong?

Ans.—Caucasian, African, American and Mongolian.

5. What is the largest city in the Southern Hemisphere?

Ans.—Rio Janeiro.

6. Name three cities in the Mississippi Valley having more than two-hundred and fifty thousand inhabitants each; and three, on the Atlantic slope, having more than three-hundred thousand inhabitants each?

Ans.—Chicago, St. Louis and Cincinnati. New York, Philadelphia, Boston

7. Name the States that border on the Great lakes.

Ans.—Minn., Wis., Mich., Ill., Ind., Ohio, Pa., and N. Y.

8. What is the Ecliptic?

Ans.—It is the plane of the earth's orbit, and was so named because it was early observed that eclipses occur when both bodies are in or near this plane.

9. What two meridians divide the earth into an Eastern and Western Hemisphere?

Ans.—The 20th west and the 160th east.

10. Bound Darke County by counties giving the county seat of each.

Ans. Mercer, Celina; Auglaize, Wapakoneta; Shelby, Sidney; Miami, Troy; Montgomery, Dayton; Preble, Eaton; Wayne, Richmond; Ranpolph, Winchester; Jay, Portland.

1. How is the change of day and night produced? Of the seasons?

Ans.—By the earth's diurnal motion. Revolution of the earth around the sun in connection with the inclination of the axis.

2. How do you account for the name and location of the tropics and polar circles, and, if ever, when are the sun's rays vertical at these points?

Ans.—The polar circles are located $23\frac{1}{2}^{\circ}$ from the poles, because on the longest day the sun shines $23\frac{1}{2}^{\circ}$ beyond the pole. *Arctic* means *northern*, and *Ant-arctic*, means *opposite to arctic*, or *southern*. The tropics are named from the signs in the Zodiac in which the sun is at the time it is vertical at these places, June 21 and Dec. 21.

3. What is the difference between a river basin and a river bed?

Ans.—River basin is the country drained by a river system and the bed is the ground over which the water flows.

4. What is meant by density of population? How is it found? Where is the center of population of the U. S.?

Ans.—The number of people to a certain area, and is found by dividing the number of people by the area. The center of population in the United States is moving westward, it is about ten miles west of Cincinnati.

5. Through what bodies of water would you sail from St. Petersburg to Calcutta?

Ans.—By means of canals and rivers I would go to the Black Sea; thence by Bosphorus Strait, Sea of Marmora, Dardanelles Strait, Archipelago, Mediterranean Sea, Suez Canal, Red Sea, *Gate of Tears*, Gulf of Aden, Indian Ocean, and Bay of Bengal.

6. (a) How has the soil been formed? (b) When is soil fertile? (c) Upon what does the distribution of plants depend?

Ans.—By the disintegration of the rocky crust that originally formed the surface, mixed with the result of vegetable and animal decomposition. This disintegration was effected partly by action of oxygen, acids, and alkaline substances brought by the atmosphere and partly by the action of water and glaciers. The soil in this country is about a hundred feet deep, and is due to drift by glacier action. Soil is fertile when it contains a large proportion of the constituent elements that enter into the production of vegetable matter. Vegetation depends upon heat and moisture; hence its distribution is governed by the climatic zones.

7. Name the foreign possessions of Great Britain.

Ans.—The principal foreign possessions are as follows: Dominion of Canada, Balize, Bahama Islands, Jamaica, Trinidad, about half of the Lesser Antilles, Falkland Islands, British Guyana, India, Ceylon, Australia, New Zealand, Tasmania, Feejee Islands, Cape Colony, Transvaal, Natal, Sierra Leone.

8. Where are the Sandwich Islands, and for what are they noted? For what is Iceland noted?

Ans.—In the Pacific Ocean, of volcanic origin and contain the largest volcanoes in the world. These islands afford excellent pasturage and large herds of cattle are fattened to supply meat to whalers, merchant ships. They form the independent kingdom of Hawaii. Iceland is noted for its active volcanoes and geysers, and its immense sulphur deposits.

9. Name ten peninsulas.

Ans.—Fla., N. S., L. Cal., Alaska, Scandinavian, Italy, Morea, Malay, Corea, and Labrador.

10. What is meant by natural divisions, and what by political?

Ans.—Natural divisions are those formed by nature, and political divisions, those formed by man.

SPELLING.

Chloroform, practitioner, guillotine, oriflamme, canteen, tambourine, extreme, mosquito, panicle, pansy, kaolin, pyrites, cretaceous, cygnet, guinea-pig, aorta, yacht, bourgeois, transom, shampoo.

Aisle, chickaree, nauseous, rime, lacerate, beauteous, anonymous, felonious, collectible, control, indelible, deciduous, noxious, transient, gala, lyre, nuciferous, maelstrom, precision, gauzy.

NOTE.—The grades of applicants in spelling run low. Questions in orthography would perhaps be a better test.

HISTORY.

1. Who is the Governor of Ohio?

ANS.—J. B. Foraker, inaugurated Jan. 11, 1886.

2. When did the Ohio Legislature convene? Of what two branches is it composed?

ANS.—Legislature convened Jan. 4, 1886. It consists of two houses, Senate and Representatives.

3. What Vice-President was elected by the Senate?

ANS.—At the autumn election of 1836 the electors failed to unite upon a Vice President, and the Senate chose Colonel Richard M. Johnson, of Ky.

4. Name the first and last States admitted into the Union and give dates of admission.

ANS.—Vermont, 1791. Colorado, 1876.

5. When and from whom was Alaska purchased?

ANS.—In 1867, from Russia, for \$7,200,000.

6. To whom were the following epithets respectively applied: "Old Hickory." "The Expounder of the Constitution." "The Mill-boy of the Slashes." "The Sage of Kinderhook." "The Sage of Monticello." "Mad Anthony." "Lady Rebecca?"

ANS.—"Old Hickory" was applied to Andrew Jackson. "Expounder of Constitution" to Franklin. "Mill-boy of the Slashes" to Henry Clay. "Sage of Kinderhook" to Van Buren. "Sage of Monticello" to Jefferson. "Mad Anthony" to Gen. Wayne. "Lady Rebecca" to Pocahontas.

7. What three cities have successively been the seat of Government of the U. S.?

ANS.—New York from 1789 to 1790; Phila., 1790 to 1800; and Washington from 1800 to present.

8. What was the Geneva Tribunal?

ANS.—In the summer of 1872 the "Alabama Claims" were submitted to a board of commissioners from five friendly nations. This board met at Geneva, Switzerland, and having heard the lawyers on both sides, decreed that Great Britain should pay to the U. S. \$15,500,000.

9. Give the date of the assassination of Abraham Lincoln.

ANS.—April 14, 1865, by John Wilkes Booth, a half-mad actor, who entered his private box and shot him through the head.

10. What Presidents of the U. S. were federalists?

ANS.—George Washington and John Adams.

1. Into what three departments is the Federal Government divided and what are the functions of each?

ANS.—The Legislative, which makes the laws; the Judicial, which expounds them; and the Executive, which executes them.

2. Of what is the United States composed at present? Which was the last State admitted?

ANS.—Of thirty-eight states, ten territories, and the District of Columbia. Colorado.

3. From what place, and in what month, did Columbus set sail to make discovery of land?

ANS.—From Santes Roads, near Palos, Spain, before sunrise, Friday, Aug. 3, 1493.

4. Describe the careers of the *Merrimac* and the first monitor.

ANS.—When Virginia seceded April 17, 1861, U. S. property was seized at once. On the 21st, Capt. McCauley of the Gosport Navy Yard at Norfolk, withdrew the Union forces, destroying most of the shipping. The *Merrimac*, which was the finest vessel in the yard, was scuttled and sunk. The Confederates afterwards raised her, and fitted her up on a grand scale for the total destruction of the U. S. Navy. She appeared in Hampton Roads a little past noon March 8, 1862, and sank the *Cumberland* with one stab of her immense iron beak. The next victim was the *Congress*, and she returned to Norfolk for the night, confident that on Sunday, the 9th, she could finish her conquest. But when she bore down upon the *Minnesota* early in the morning, the unexpected little antagonist darted out to oppose her, when a most terrible iron-clad duel ensued. The little turreted *Monitor*, mounting but two guns, stood up successfully to the defense of 21 ships-of-war, mounting 296 guns, all alike defenseless against the attack of the iron-clad *Merrimac*. She was a modern David, taking the forefront of the battle against a modern giant Goliath, while the hosts stood by, anxious spectators of the conflict.

From the 10th of March until the destruction of the *Merrimac* on the 11th of May, when Huger exploded her before he fled on the evacuation of Norfolk, the *Monitor* remained at Hampton Roads, guarding the Elizabeth and James rivers, always ready for her rival. May 8th she engaged the battery on Sewell's Point, and on the 12th led the vessels to Norfolk, when Gen. Wool was met by the mayor with a flag of truce. On the 15th she was engaged at Ft. Darling, 7 miles below Richmond, and from that time to Aug. 31, she patrolled the James River. In September proceeded to Washington Navy Yard for repairs, and again sailed for Hampton Roads in November. Dec. 29th, under command of John P. Bankhead, she sailed for Beaufort, N. C., and on the night of the 30th she foundered near Cape Hatteras. About half her officers and crew went down with her, and the others escaped to the *Rhode Island*, her convoy.

John Ericsson, the noted Swede, forwarded from New York Sept. 26, 1854, to Napoleon III., a plan of the ship, but the emperor did not favor a contract, so the first monitor was built for the United States. Contract to build the original *monitor* was made Oct. 4, 1861, with Gideon Welles by the inventor and three others. Price, \$275,000. She was launched Jan. 30 1862, and her first trial trip and delivery to the navy yard was Feb. 19, 1862. She left New York March 6, under command of John L. Worden, and on the 8th reached Hampton Roads. For facts concerning the construction of the *monitor*, see Executive Document, No. 85, 40th Congress, 2d Session.

5. Who were the Pilgrims? Why did they come to America?

ANS.—They were non-conformists in England, exiles in Holland, and founders of the New-England States. A peculiar religious people, seeking that liberty and peace of worship which they were not willing to give to others. For this purpose they came to the desolate shores of the New World.

6. Who was Blennerhasset?

ANS.—Harman Blennerhassett, born in Hampshire about 1770, was an Irish exile, who, in 1798, purchased and adorned an island in the Ohio River, fourteen miles below Marietta. He had an accomplished wife and several children, with a home that became the center of attraction in all the country.

In 1806, Burr stopped at the island, formed the acquaintance of his host and by a singular fascinating power, led him into a project to form a military expedition against the Spanish provinces in the South-west, to revolutionize the territory west of the Alleghanies, and to establish an independent government. New Orleans was to be the capital and Burr the ruler of this independent empire.

Blennerhassett furnished money, and his island became the rendezvous for military stores and provisions. Genl. Wilkison, Gov. of Louisiana and residing at St. Louis, honored a secret correspondence in cipher from Burr, but finally betrayed him by making known to President Jefferson the true design of Burr. Jefferson immediately issued a proclamation (Nov. 27, 1806), warning the people of the West to withdraw from unlawful enterprises and commanded all officers to bring the offenders to condign punishment. Gov. Tiffin, of Ohio, accordingly sent the militia to the rendezvous, who seized the boats and stores, while Blennerhassett and others escaped down the river, joining Burr at the mouth of the Cumberland. The whole company now numbered about 80 men, who were led on by Burr, ignorant of his ultimate designs. At Natchez they disbanded, and Burr was arrested in Alabama by Capt. Gaines and sent to Virginia. The authorities of Virginia sent an officer to arrest Blennerhassett, but the mistress of the island, who, with a pistol in each hand, ordered him to depart on pain of death, while her husband escaped into Kentucky where he was afterwards arrested and put into prison with Burr at Richmond. Burr came there March 26, 1807, and his trial commenced Aug. 3, and continued till October, when he was acquitted. Blennerhassett's case was decided likewise. Blennerhassett was now financially distressed, and suffered poverty to the end of his life. He died in 1831.

7. What striking similarity exists in the causes leading to the founding of the colonies of Massachusetts, Rhode Island, Maryland, and Pennsylvania?

Ans.—The “striking” similarity exists in the fact that each of the colonies named was settled by exiles who sought religious liberty. Massachusetts by the puritans spoken of in 5th. Rhode Island by Roger Williams and Anne Hutchinson, who had to flee for their lives from Massachusetts. Maryland founded by Lord Baltimore to be a place of refuge for English Catholics. Pennsylvania, by the “holy experiment” of William Penn, became a free colony for all mankind, and drew thousands of immigrants who were eager to escape from spiritual and temporal despotisms.

8. Where, when, and by whom, and for what nation, was the mainland of North America discovered?

Ans. At New Foundland (*Prima Vista—first view*) John Cabot landed June 24, 1497, and soon after his return. Sebastian, his son, set sail with 300 men, and explored the coast as far south as Albemarle Sound, and took possession of the whole for the crown of England.

9. Name the great exploring nations of Europe.

Ans.—English, French, Portuguese and Spanish.

10. By what nation was each of the original colonies settled, and what kind of government had each in 1775?

Ans. —PROVINCIAL GOVERNMENT. New Hampshire by the English at Portsmouth in 1623; New York by the Dutch at New York in 1614; Virginia by the English at Jamestown in 1607; New Jersey by the English at Elizabethtown in 1665; North Carolina by the English at Albemarle in 1663; South Carolina by the English at Charleston in 1670; and Georgia by the English at Savannah in 1733.

CHARTER GOVERNMENT.—Massachusetts by the English at Plymouth in 1620; Rhode Island by the English at Providence in 1636; and Connecticut by the English at Windsor in 1633.

PROPRIETARY GOVERNMENT.—Pennsylvania by the Swedes at Philadelphia in 1643; Maryland by the English at St. Mary's in 1634; Delaware by the Swedes at Christiana in 1638.

GRAMMAR.

1. Write a sentence limiting the subject by an adjective element of the 3d class, and the predicate by an adverbial element of the 3d class.

Ans.—Mr. Wilson, *who teaches at the deserted village*, came to the meeting *that he might receive inspiration*.

2. Combine the following separate statements into a single sentence:

1. We saw a beautiful landscape. 2. We had climbed to the top of the hill. 3. The landscape was stretched before us.

Ans.—After climbing to the top of the hill, we saw a beautiful landscape stretched before us.

3. Write a sentence containing nouns in the nominative and objective cases by apposition.

Ans.—Artemas Martin, a *mathematician* of world-wide fame, is now in the U.S. Coast Survey Office at Washington, the *city* of magnificent distances.

4. How many elements in sentences, and how many classes of each?

Ans.—The principal elements are distinguished as adjective, adverbial, and objective. Attendant elements are nouns and pronouns in the nominative absolute case; interjections; expletives; and all phrases and clauses which have no connection with the rest of the sentence.

5. Give the divisions of the verb with respect to use and form.

Ans.—Form—regular and irregular. Use—transitive and intransitive.

6. Give the common, emphatic, progressive and passive forms of the third person, indicative present of the verb “teach.”

Ans.—I teach. I do teach. I am teaching. I am taught.

7. Define voice, conjugation, analysis, punctuation and synthesis.

Ans.—See text-book.

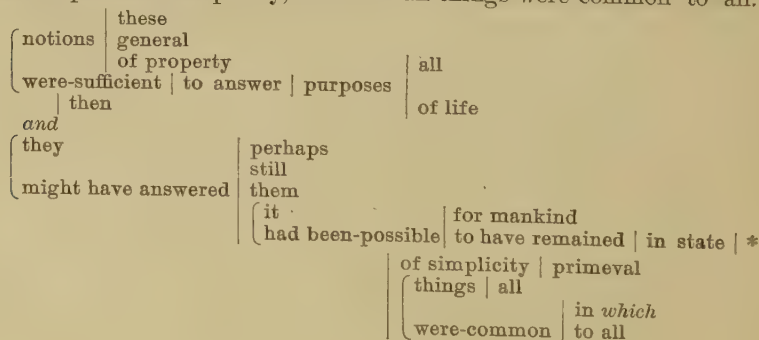
8. What auxiliaries are sometimes used as principal verbs?

Ans.—HAVE, from the Anglo-Saxon *habban*, to *have*. WILL, Anglo-Saxon *willan*. DO, Anglo-Saxon *don*, marks the emphatic form of the verb, when used as an auxiliary. BE and LET.

9. Write possessive plural of woman, boy, child, brother-in-law, ox.

Ans.—WOMEN'S. BOYS'. CHILDREN'S. BROTHERS-IN-LAW'S. OXEN'S.

10. Diagram. — These general notions of property were sufficient to answer all purposes of human life; and might perhaps, still have answered them, had it been possible for mankind to have remained in a state of primeval simplicity, in which all things were common to all.



1. Define *proposition*, *clause*, *phrase*, *ellipses* and *modifier*.

ANS.—*Ellipsis* is a figure of syntax and denotes the omission of a word or words, necessary to complete the construction of a sentence, but not essential to its meaning. *Modifier* is a word, phrase or clause limiting the meaning or application or any part of a sentence. For a full definition of the first three, see p. 15, of Jan. No.

2. What is a collective noun? How is its gender determined?

ANS.—It is the name of a body or collection of living individuals. When it conveys the idea of unity, neuter gender: when of plurality, it takes the gender of the individuals composing the collection.

3. What is an abridged sentence? Write one, and rewrite it, taking it out of the abridgment.

ANS.—A contracted form of a proposition; as, A man who is energetic will succeed = An energetic man will succeed. That some one should fail is certain = to fail is certain.

4. Define the degrees of comparison. What parts of speech are compared?

ANS.—*Positive* is the degree expressed by an adjective in its primitive form. *Comparative* is a higher degree than some other with which it is compared. *Superlative* is the highest degree of all that are compared. Adjectives and adverbs are compared.

5. Write short sentences, one with an infinitive limiting an adverb, and one with an infinitive limiting an adjective.

ANS.—He was *too* proud *to apologize*. He is *unable to pass* an examination. (See p. 65, Vol. 6, for seventy-two sentences, each showing some construction of the infinitive).

6. Distinguish between a participial noun and a participle having the construction of a noun.

ANS.—A participial noun does not possess the distinctive properties of a verb or participle, and can not have an object nor be modified by an adverb, like a participle.

7. Write short sentences illustrating the different uses of *that*.

ANS.—It is a noun in the question. *That* (adj.) boy came. Applicants *that* (rel. pro) work hard should succeed. *That* (expletive) you should read the *Visitor*, is obvious. He taught *that* (conj.) you might learn.

8. When is *as* a relative pronoun? *What*?

ANS.—*As* is a relative after *such*, *many*, *much* or *same*, or when it refers to an antecedent. *What*, when it has an antecedent, or when it can be changed into the thing which.

9. When does a preposition become an adverb?

ANS.—When its object is omitted; as, An hour passed *on*.

10. Diagram or analyze, and parse italicized words:

Teach me to feel another's woe,

To hide the fault I see;

That mercy I to others show,

That mercy show to me.

(thou		me		to feel		woe		another's
teach								
and		thou		to hide		fault		(I
(show		mercy		to me		that		
				(show		to others		

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

818. Why do the Gulf Stream and the Japan Current flow toward the north-east?

If the earth was at rest, and the wind absent, the direction of both the equatorial and polar currents would be due north and south. But by the rotation of the earth, the currents flowing towards the poles are deflected towards the east; those flowing towards the equator, towards the west. J. W. KEOKLER.

819. State the influence of deeply articulated coasts upon the progress of civilization.

Ans.—Deeply indented coasts are of the greatest importance to civilization, because they not only afford good harbors which promote to a high degree a diffusion of industries, knowledge and civilization, but they also modify and temper the climate, thus increasing the fertility and productiveness of a country. Europe ranks first in commercial and intellectual importance, and has a mile of coast for every 190 sq. mi. of area. Australia 1 to 300; North America 1 to 368; South America 1 to 449; Asia 1 to 500; and Africa 1 to 750.

EDITOR.

820. What are redundant letters? Explain by examples.

Ans.—Such that can be replaced by others; as, *c* in *civil* may be replaced by *s*; and in words like *cavil* by *k*; *ch* in words like *chapel*, is equivalent to *tsh*; and in words like *chaos*, to *k*. In like manner, *x* is redundant, *ks*, *gz*, or *z* being its equivalents. *Q* is superfluous, because we can use *cw* or *kw* as its equivalents.

EDITOR.

821. Can a fat man swim easier than a lean one? Why?

Ans.—Since fat is lighter than bones, the buoyancy of the water would be of more material aid to a fat man in swimming than a lean one. H. A. Wood.

822. Give a sketch of the Savilian Professor, who is spoken of as the greatest mathematician of his age.

Ans.—The celebrated Savilian Professor was D. D. Wallis, born at Ashford, Kent Co., England, Nov. 23, 1616, and died at Oxford, Oct. 28, 1703. He graduated at Cambridge about 1636; became a fellow of Queen's College; took orders in the Church of England; was chaplain to Sir Richard Darley and to lady Vere; became an expert in discovering the keys to MSS. written in cipher, and for this purpose was employed by the Long Parliament; was secretary to the Westminster Assembly of Divines, 1644; became Savilian professor of geometry at Oxford 1648, and keeper of the archives 1658. He had a controversy with Hobbes who pretended to have discovered the quadrature of the circle, and attracted notice by his success in teaching a deaf and dumb child to speak. He was one of the revisors of the Book of Common Prayer, 1661, and edited the posthumous works of Jeremiah Horrox. His writings including his theological controversies with the Arians, Baptists, and Sabbatarians, are extensive. His work on the Arithmetic of Infinities was of great service to Sir Isaac Newton, as fore-shadowing the latter's brilliant discoveries in the binomial theorem and method of fluxions.

H. A. Wood.

824. The difference between $\frac{2}{3}$ and $\frac{1}{3}$ equals the sum of their cubes; are there other such fractions?

Ans.—Able solutions to this problem were given in the Mathematical Diary, 1832, by Benjamin Pierce, C. Gill, and G. B. Docharty. The results there given are $\frac{13}{42}$ and $\frac{1}{42}$, $\frac{195}{671}$ and $\frac{163}{671}$, $\frac{5403073}{18560833}$ and $\frac{4639388}{18560833}$.

H. A. Wood.

825. Why is the period of time of the turning of the earth on its axis divided into twenty-four parts called hours? Why not twenty or thirty?

U. H.

Ans.—The subdivision of the day into twenty-four parts, called hours, has prevailed since the remotest ages. The ancient Egyptians consecrated each hour to a particular planet. In their astronomy the order of planets, beginning with the most remote, was Saturn, Jupiter, Mars, the Sun, Venus, Mercury, the Moon. Each day of the week took its name from the planet which presided over its first hour. They commenced their civil day at midnight as we do. According to Dio Cassius, their week commenced with Saturday, but the Jews on their flight from Egypt made Saturday the last day of the week, from hatred to their ancient oppressors. We here give the 168 hours of the week, which illustrates the cycle under consideration.

SATURN.	JUPITER.	MARS.	SUN.	VENUS.	MERCURY.	MOON.
<i>Saturday</i>	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	<i>Sunday</i>	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	<i>Monday</i>
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	<i>Tuesday</i>	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	<i>Wednesday</i>	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	<i>Thursday</i>	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	<i>Friday</i>	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24

The English names of the days, however, are derived from the Saxon. The ancient Saxons had borrowed the week from some Eastern nation, and substituted the names of their own divinities. In legislative and justiciary acts the Latin names, corresponding to the above table, are still retained.

LATIN.	ENGLISH.	SAXON.
Dies Solis (Sun's day).	Sunday.	Sun's day.
" Lunæ (Moon's day).	Monday.	Moon's day.
" Martis (Mars's day).	Tuesday.	Tiw's day.
" Mercurii (Mercury's day)	Wednesday.	Woden's day.
" Jovis (Jupiter's day).	Thursday.	Thor's day.
" Veneris (Venus's day).	Friday.	Friga's day.
" Saturni (Saturn's day).	Saturday.	Seterne's day.

This may be new to many of our readers, and we think it will be read with profit.

EDITOR.

826. Who wrote Washington's Farewell Address?

G. M.

Ans.—After Washington declined a third term, he prepared his *Farewell Address to the People of the United States*, placed it into the hands of Alexander Hamilton, who gave it a careful revision. Renwick says, "The Address would

have been less perfect as a composition had it not passed through the hands of Hamilton." Washington testified his great esteem for his Ex-Secretary of the Treasury by employing him as literary scavenger, and on Sept. 17, 1796, that last direct utterance of the father to his countrymen was issued. It was full of practical wisdom and rich with patriotism.

EDITOR.

827. What was called the *House of Wisdom*? The *Land of Summer*?
G. B.

ANS.—In June, 1639, the leading men of New Haven held a convention in a barn, and formally adopted the Bible as the constitution of the state. Everything was strictly conformed to the religious standard. The government was called the *House of Wisdom*, of which Eaton, Davenport, and five others were the Pillars. None but church members were admitted to the right of citizenship. All offices were to be filled by the votes of freemen at an annual election. For twenty years consecutively, Mr. Eaton, first and greatest of the pillars, was chosen governor of the colony.

J. W. KECKLEE.

829 & 830. Give nicknames and locate the graves of the Presidents.

ANS.—GEORGE WASHINGTON, *Father of his Country*, was born on the Potomac, in Virginia, Feb. 22, 1732, and died Dec. 14, 1799. His remains were deposited in their present resting place at Mt. Vernon, Va., in 1837.

JOHN ADAMS, *The Colossus of Independence*, born at Quincy, Mass., Oct. 19, 1735, and died about sunset, July 4, 1826, a few hours after the death of Jefferson. Beneath the Unitarian Church in Quincy lie the remains of him and his son John Quincy Adams.

THOMAS JEFFERSON, *The Sage of Monticello*, was born at Shadwell, Va., April 2, 1743, and died about noon, July 4, 1826, and his grave may be found in a dense woods to the right of a road from Charlottesville to Monticello, Va.

JAMES MADISON, *Father of the Constitution*, was born at King George, Va., March 16, 1757, and died June 28, 1836. His grave is in the center of a level field at Montpelier, Va.

JAMES MONROE, *The Honest Man*, born in Westmoreland Co., Va., April 28, 1758, died July 4, 1831, and is buried in Hollywood Cemetery, Richmond, Va.

JOHN QUINCY ADAMS, *The Old Man Eloquent*, was born July 11, 1767, and died of paralysis Feb. 23, 1848, in the midst of his duties while occupying his seat in the House of Representatives.

ANDREW JACKSON, *Old Hickory and Sharp Knife*, was born in the Waxhaw settlement, N. C., March 15, 1797, died June 8, 1845, and was buried at the Hermitage, his noted residence on the Lebanon Pike, 11 miles from Nashville, Tenn.

MARTIN VAN BUREN, *The Little Magician*, sleeps in the village cemetery of Kinderhook, N. Y., where he was born Dec. 5, 1782, and where he died July 24, 1862.

WM. H. HARRISON, *The Log Cabin Candidate*, was born in Berkeley, Va., Feb. 9, 1773, died April 4, 1841, and his grave is in Ohio, near North Bend, Ind., only a few yards from the I. C. & L. Railway where it enters a tunnel. A neat marble slab with a plain inscription marks the spot.

JOHN TYLER, *The Corporal*, born in Va., March 29, 1790, and died Jan. 18, 1862. He is buried in Hollywood Cemetery, Richmond, Va., and it is said his grave is unmarked, save by a juniper and two magnolia trees.

JAMES K. POLK, , born in Mecklenburg Co., N. C., Nov. 2, 1795, and died June 15, 1849. His remains occupy a beautiful spot at the corner of Vine and Union Streets, Nashville, Tenn.

ZACHARY TAYLOR, *Old Rough and Ready*, was born in Va., Sept. 24, 1784 and died July 9, 1850. After three removals, his ashes now repose among the illustrious dead in the cemetery at Frankfort, Ky.

MILLARD FILMORE, , born in Cayuga Co., N. Y., died at Buffalo, N. Y., March 8, 1874, where he is buried in Forest Lawn Cemetery.

FRANKLIN PIERCE, , was born at Hillsborough, N. H., Nov. 23, 1804, and died Oct. 8, 1869. Buried at Concord, N. H.

JAMES BUCHANAN, , born at Stony Batter, Pa., April 22, 1791, died at Lancaster, June 1, 1868, where he was buried in Woodward Hill Cemetery on the banks of the Conestoga.

ABRAHAM LINCOLN. *Honest Old Abe* and *The Rail Splitter*, was born in Hardin Co., Ky., Feb. 12, 1809, and died at 7:22, A. M. April 15, 1865, from the effects of the ball shot by Booth and which entered Mr. Lincoln's head in the rear, passed through the brain, and lodged just back of the right eye. Buried at Oak Ridge Cemetery, Springfield, Ill., where an outrageous attempt was made Nov. 7, 1876, to steal the remains from the vault in which they were lying.

ANDREW JOHNSON, *The Tailor*, was born at Raleigh, N. C., Dec. 29, 1808, and died Aug. 1, 1875. Buried at Greenville, Tenn.

ULYSSES SIMPSON GRANT [Hiram Ulysses] *The Soldier* and *The Silent Man*, was born at Mt. Pleasant, Ohio, April 27, 1822, and died at Mt. Gregor, N. Y., July 23, 1885. He was buried with imposing ceremonies on an eminence at the upper end of Riverside Park, New York City, Aug. 8.

JAMES ABRAHAM GARFIELD, born in Ohio, Nov. 19, 1831, died Sept. 19, 1881. Buried in Lake-View Cemetery, Cleveland, Ohio.

831. Describe the phenomenon at mouth of Para River. K.

ANS.—We presume the proposer has reference to the *bore* which forms at the mouth of the Para. The bore is the result of the struggle between the ascending tidal wave and the opposing current of the stream which produces the phenomenon of a huge wave advancing with great rapidity, with a deep roaring noise, often for hundreds of miles. In the Chinese river Tsientang it rises to thirty feet in height, and travels at the rate of twenty-five miles an hour, sweeping every thing before it. In the Amazon river they attain a maximum at the time of the equinoxes, when bores fifteen ft. in height follow each other in quick succession, and within the space of 200 miles five such mighty waves may be seen traveling simultaneously up the river. H. A. WOOD.

832. Where is the "Land of the Midnight Sun"? H. L. Y.

ANS.—Portion of Greenland, Norway and the islands north of the Arctic Circle may be thus called. Hammerfest on an island in the north of Norway, lat. 70°40' is the most northern town and inhabited region in the world, and is truly in the land of the midnight sun. Here the sun does not set from the 1st of June to July 22. For a short time prior to June 1, and after July 22, the sun rises and sets in the north dipping beneath the horizon but a few minutes. In the winter the sun sets Nov. 17, and does not rise again till Jan. 28. A short time previous to Nov. 17 and after Jan. 28, the sun rises and sets in the south showing his disc but few minutes and then disappears. The children go to school with lanterns for about six weeks. It is said Hammerfest has more children for the size of the place (pop. 2,000) than any other town. The people live chiefly on fish and reindeer. At the northern cape (Bird's Cape) is a granite pillar surmounted by a bronze globe, with projecting axis to show the plane of the celestial pole, and on two sides of the pillar are inscriptions in Latin and Norwegian, stating that it was one of the stations for the measurement of the arc of the meridian, and the spot chosen by Capt. Sabina for his series of pendulum experiments in 1823. It was one of a chain of stations from the equator towards the pole, at which pendulum observations were made for obtaining the variations of gravity on the earth's surface. EDITOR.

833. Why are some regions like the Sahara rainless, while almost constant rain falls in other places as Guinea? A. M. R.

ANS.—Because the winds in passing over some elevation of land have been deprived of their moisture; by passing over the mountains of Asia the winds are deprived of their moisture before they reach the Sahara. And Guinea receives its moisture immediately from the ocean, J. W. KECKLER.

QUERIES.

867. Explain how the vibration of the pendulum proves the earth to be an oblate spheroid. AARON MOUL.

868. What is meant by *The cackling of Geese saved Rome*?

DARKE.

869. Why was Scott's army called "Army of Occupation"? Id.

870. Who originated the idea of the Postal Card? S.

871. Where is the "Valley of Death"? Id.

872. What does "Pouring oil on troubled waters" mean? Id.

873. Give incident in English history upon which was founded, *Curfew must not ring to-night*. Id.

874. What is placed in the floor to commemorate the spot where Garfield fell when shot? J. W. CLARK.

875. What is meant by the "Truce of God" as mentioned in French history? H. A. WOOD.

876. What commander said, "Spare the soldiers, but slay the gentlemen"? Id.

877. What is the origin of the title *Prince of Wales*? Id.

878. Why are four I's (IIII) instead of IV. on dials of clocks and watches? A. L. FOOTE.

879. Who said—"Laugh where we must, be candid where we can"? Id.

880. Give author and reference of following. W. A. MARSH.

Sweet bird, thy bower is ever green,

Thy sky is ever clear;

Thou hast no sorrow in thy song,

No winter in thy year.

881. What State Legislatures passed "Personal Liberty Laws"? W. F. L. SANDERS.

882. How many votes had the owner of a hundred slaves, 60 or 61? Id.

883. What part of the Alien Law of 1798 is still the law of the land? Id.

884. What was the Clayton-Bulwer Treaty? Id.

885. What was Jefferson's Proviso in regard to slavery? When was it voted on? Id.

886. What was the Fitz-John-Porter Bill? Id.

887. When was the fine ship *Atlantic* lost? Give some particulars of the affair. Id.

888. Give the best definition of education you can. JAS. SMITH.

889. How would you keep the primary pupils busy? Id.

890. What is the so-called "New Education"? Id.

891. What is now the *Presidential Succession*? Explain fully. *

Answers should be received on or before March 15.

Our pupils, J. W. Clark, Orval Hyer, Hannah Hershey, Myrtle George, Flora Brown, and Jennie Stoltz favored us with some good answers. Also Harry Recher, of West Sonora, and J. W. Keckler, of Hagerman, Ohio.



EDITED BY

JOHN S. ROYER.

VOL. VII.

MARCH, 1886.

No. 3.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

842. A well 3 ft. in diameter is under a horizontal roof 10 ft. high. What is the length of the longest pump-stalk that can be inserted? B. F. FINKEL.

By WM. WILEY, Detroit, Mich.

Let $AB=3$ ft., a diameter of well at top, CAD the shortest straight line from C , a point in the roof, through A to a point D in the well directly below B , and let s be the sine and c the co-sine of the angle BAD . Then

$$CA = \frac{10}{s}, \quad AD = \frac{3}{c}, \quad \text{and the line } CAD \text{ is } \frac{10}{s} + \frac{3}{c}.$$

The first differential co-efficient is

$$-\frac{10c}{s^2} + \frac{3s}{c^2} = 0; \quad \therefore 10c^3 = 3s^3, \quad \frac{c^3}{s^3} = \frac{3}{10}, \quad \text{and } \frac{c}{s} = \left(\frac{3}{10}\right)^{\frac{1}{3}} = \cot BAD.$$

The angle BAD is therefore $56^\circ 12' 1''$, and the required length of stock (which is considered a line)

$$CAD = 10 \div s + 3 \div c = 12.033888 + 5.392878 = 17.429763 \text{ ft.}$$

Or, since $10c^3 = 3s^3$, $10c^3 = 3(1-c^2)$, and squaring $100c^6 = 9(1-c^2)$, which reduces to $109c^6 - 27c^4 + 27c^2 = 9$, and by Horner's method gives $c = .556290$ which is $\cos 56^\circ 12' 1''$, as before, presenting an interesting instance of the unity of mathematics.

ERRATA. In last issue p. 32, last line of Prob. 859 should be "indicated by 4⁴⁴."

Page 34, last line of first answer read *adjective* instead of "adverb".

Page 35, answer to 3d, insert period and read \$4.80.

Page 39, answer to 6th question, 2d line, "Franklin" should be *Webster*.

$$\left\{ \frac{l}{2r} - \frac{\sqrt{lr}}{r} + \frac{1}{4} \left(1 + \frac{r}{l} + \frac{r^2}{l^2} + \frac{r^3}{l^3} + \text{etc.} \right)^{\frac{1}{2}} \right\} dr.$$

Extracting the root of this series we have

$$\left(\frac{\sqrt{l}}{\sqrt{2r}} - \frac{\sqrt{2}}{2} - \frac{\sqrt{2r}}{8\sqrt{l}} - \frac{r\sqrt{2}}{8l} - \text{etc.} \right) dr.$$

Integrating, we find the first four terms to be

$$\sqrt{2lr} - \left(\frac{r}{2} + \frac{1}{12} \frac{r^3}{\sqrt{l}} + \frac{r^2}{16l} + \text{etc.} \right) \sqrt{2} = \frac{1}{4} l \sqrt{2} = 5.7616 \text{ feet for}$$

half the curve, and $2 \times 5.7616 = 11.5232$ feet. The value of r is taken at the maximum radius vector, or where $\sqrt{(x^2 + y^2)} = \text{maximum}$, and $r = \frac{1}{3}l$, $x = \frac{2}{3}l$, $y = \frac{2}{3}l\sqrt{3}$. Maximum radius vector $= \frac{2}{3}l\sqrt{3}$, $x + r = \frac{2}{3}l = 13\frac{1}{3}$ feet, distance up the ladder at maximum radius vector.

844. An anchor ring made of 3 inch round iron, has for its diameters 18 and 24 inches, interior and exterior. Find the volume of a segment of this ring made by a plane passing $\frac{1}{4}$ in. from the center of the rim and parallel to the plane of the ring.

HENRY GUNDEE.

By A. L. FOOTE, *Hempstead, N. Y.*

If we imagine the solidity of the section of the ring to be generated by the revolution of the segment revolving about the center, we have the radius $9 + 1\frac{1}{2} = 10\frac{1}{2}$ and the circumference is 21π . For the area of the segment, we have

$$1 : 1\frac{1}{2} : : \sin \theta : \frac{3}{4}\sqrt{3}, \text{ or } \sin \theta = \frac{1}{2}\sqrt{3} = 60^\circ.$$

Hence angle of sector is 120° and area of sector $\frac{1}{3} \times (1\frac{1}{2})^2 \times \pi = \frac{3}{4}\pi$, and the triangle is $\frac{3}{4} \times \frac{3}{4}\sqrt{3} = \frac{9}{16}\sqrt{3}$, segment is $\frac{3}{4}\pi - \frac{9}{16}\sqrt{3}$, and solidity $21\pi(\frac{3}{4}\pi - \frac{9}{16}\sqrt{3}) = 91.170329$.

By WM. WILEY, *Detroit, Mich.*

A volume of revolution equals the revolving surface multiplied by a circumference whose radius is the distance of the axis of rotation from the center of gravity of the surface. This circumference is 21π . If radius of round iron were unity, the surface of the segment would be $\frac{1}{3}\pi - \frac{1}{4}\sqrt{3}$. But radius is $1\frac{1}{2}$; hence the volume of segment is

$$(1\frac{1}{2})^2 \times (\frac{1}{3}\pi - \frac{1}{4}\sqrt{3}) \times 21\pi = 91.17 \text{ cu. in.}$$

845. A merchant buys a bill of goods amounting to \$2480; he can have 4 months' credit, or 5% off for cash: if money is worth only 10% to him, what will he gain by paying cash?

E. R.

By B. F. FINKEL, *N. Lewisburg*, and D. S. POND, *Rochester, O.*

The discount for cash is $\$2480 \times .05 = \124 , and the cash price $\$2480 - \$124 = 2356$. This sum could be borrowed for 4 months at 10% for $\$2356 \times .03\frac{1}{3} = \78.53 interest; hence the gain is $\$124 - \$78.53 = \$45.47$ if the money is borrowed.

By D. W. K. MARTIN, *Versailles*, and J. W. PFEIFFER, *Bolivar, O.*

Cash price is \$2480 - $(\$2480 \times .05) = \2356 . Present worth of \$2480 for 4 mo. at 10% is $\$2480 \div 1.03\frac{1}{3} = \2400 , and $\$2400 - \$2456 = \$44$, cash gain. Amount of \$44, for 4 mo. at 10% is $\$44 \times 1.03\frac{1}{3} = \45.47 gain at the time the debt is due.

REMARK.—Mr. Martin thinks the answer should be \$44. Messrs. Scripture, Leahy, Gregg, Palmer, Binkley, Brower, Russell, Stine, Kauffman, Leisy, Gensmer and Keckler get \$44 for the answer. This question is in Ray's Practical Arithmetic where the above answer is given. We think the idea of borrowing the money by simple interest to pay the debt in cash, is a good one.

846. Suppose A and B work together for 4 hours, after which A leaves and B does the remainder in 3 hr. 36 min.; but if B had left, it would have taken A 4 hr. 30 min. to finish the work. Find by arithmetic in what time each could have done it alone.

ROYER'S PROBLEMS.

By GEO. G. BROWER, *Lee Center, N. Y.*

If A finishes the remainder in $4\frac{1}{2}$ hr., he will do $\frac{2}{9}$ of it in one hour, and B finishes it in $3\frac{2}{3}$ hr., in one hour he will do $\frac{3}{13}$ of it. Together they do $\frac{2}{9} + \frac{3}{13} = \frac{1}{2}$ of it in one hour, and it would then take them 2 hours to finish the work, and working together they would do the entire work in $4 + 2 = 6$ days. In 4 days they do $\frac{4}{6}$ or $\frac{2}{3}$ of the work, and leave $\frac{1}{3}$ of it undone. If A can do $\frac{1}{3}$ of it in $4\frac{1}{2}$ hr., he can do the whole work in $3 \times 4\frac{1}{2} = 13\frac{1}{2}$ hr. If B can do $\frac{1}{3}$ of it in $3\frac{2}{3}$ hr., it will take him $3 \times 13\frac{1}{2}$, or $10\frac{1}{2}$ hr.

By J. K. ELLWOOD, *Mauch Chunk, Pa.*

B in the same time does $4\frac{1}{2} \div 3\frac{2}{3} = 1\frac{1}{4}$ times as much work as A. A works 4 hr. and B in 4 hr. does as much work as A in $4 \times 1\frac{1}{4} = 5$ hr. Hence what both did in one hour could have been done by A in 9 hr. $9 + 4\frac{1}{2} = 13\frac{1}{2}$ hr., A's time, and $\frac{4}{5}$ of $13\frac{1}{2} = 10\frac{1}{2}$ hr., B's time.

847. A, B, and C start at noon from the same point to travel around a circle of 390 rods. A walks 7 rd. and B 13 rd. per minute the same way; C travels 19 rd. per minute in an opposite direction. At what time will the three meet at the starting point, each traveling at a uniform rate?

Id.

By JOHN C. GREGG, A. M., *Brazil, Ind.*

B will catch A in $390 \div 6 = 65$ min., in which time A has gone $1\frac{1}{6}$ rounds, B $2\frac{1}{6}$ rounds and C $3\frac{1}{6}$ rounds, and each will be 65 rods from the starting point, where they will all meet in $[390 \div (2 \times 65)] \times 65 = 195$ minutes.

By A. M. SCRIPTURE, *Clinton, N. Y.*

A and C meet in $390 \div (7 + 19) = 15$ min., and every 15 min. there-

after. B will overtake A or gain the circumference in $390 \div (13 - 7) = 65$ min., and A and B will be together every 65 min. thereafter. $\therefore$ A and B and C will be together in the L. C. M. of 15 and 65, or 195 min. = 3 hr. 15 min. The time required is 3:15 P. M.

REMARK.—By a little oversight, the other contributors obtained 6:30 P. M. This and the preceding problem are good tests for classes in mental arithmetic.

849. A grocer who sells 7 lbs. of butter for the price which he pays for 8, determines to cheat both in buying and selling, by means of a false balance, 13 lb. in one scale balancing 14 lb. in the other. By this dishonesty he increases his profits by \$29 on a quantity of butter. What does he pay for that quantity?

A. M. BURCHILL.

By J. C. GREGG, *Brazil, Ind.*

Let us suppose $7a$ to be the cost of the quantity of sugar bought, then $8a$ would be the selling price. By means of the false scales he buys 14 lb. for the price of 13 lb., and sells 13 lb. for the price of 14 lbs; hence what he buys costs him $\frac{13}{14}$ of $7a = \frac{13}{2}a$, and what he sells brings $\frac{14}{13}$ of $8a = \frac{112}{13}a$, and the gain is $\frac{112}{13}a - \frac{13}{2}a = \frac{5}{26}a$. But he ought to have gained $8a - 7a = a$; hence $\frac{5}{26}a - a = -\frac{21}{26}a$ what he gained by his cheat, and the cost of the quantity is $\$29 \div -\frac{21}{26}a \times 7a = \182 .

850. The teachers in a school are $\frac{1}{21}$ of its whole number of persons, but after 40 new boys have been added the masters being $\frac{3}{50}$ of the whole. How many boys were there before the new boys came?

Id.

By GEO. A. STINE, *Lindsey, Ohio.*

Let $\frac{3}{4} + 40 =$ the number of persons after the additional 40 came. Then the teachers were $\frac{3}{50}$ of $(\frac{3}{4} + 40)$, which is $\frac{3}{24}$ of the original number, and at first these were 24 times $\frac{3}{50}$ of $(\frac{3}{4} + 40)$, or $\frac{9}{10}$ of $(\frac{3}{4} + 40) = \frac{9}{10} + 36$; hence $\frac{1}{10}$ of the original number is 36, and $360 - \frac{1}{24}$ of 360 = 345 boys.

By G. W. LEAHY, *Marshallville, Ohio.*

Let $x =$ No. of persons. Then $\frac{1}{24}x = \frac{3}{50}(x + 40)$, whence $x = 360$, and $\frac{1}{24}$ of 360 = 15 teachers and 360 - 15 = 345 boys.

851. A man bought 50 bu. of grain, paying 75 cents for rye and \$1.25 for wheat; how many bushels of each did he buy, if the grain cost him \$52.50?

G. M. MORRIS.

By P. C. PALMER, *Smithville, Ohio.*

The average cost is $\$52.50 \div 50 = \1.05 per bushel. In buying the rye he would gain 30 cents on a bushel and on the wheat he would lose 20 cents per bushel; hence that the gains and loses may be equal he must buy 20 bu. of rye for every 30 bu. of wheat.

852. How many miles of furrow 15 in. wide, is turned in plowing a rectangular field whose width is 30 rods and length 10 rods less than its diagonal?

GEO. L. SHANER.

By D. W. K. MARTIN, *Versailles, Ohio.*

The diagonal being the hypotenuse of a right-angled triangle, 30^2 or 900 must be the difference of the square of the hypotenuse and length, and since the difference of the squares of any two numbers is always equal to the product of their *sum* and *difference*, the *sum* of the diagonal and length is $900 \div 10 = 90$; hence the length is $(90 - 10) \div 2 = 40$. We have $(30 \times 16\frac{1}{2}) \div 1\frac{1}{2} = 396$ furrows 40 rods long, or $(396 \times 40) \div 320 = 49\frac{1}{2}$ mi.

853. Otto Guericke's hemispheres are said to have been 2 feet in diameter. It is sometimes stated that 30 horses, 15 on each side, were able to pull them apart. Can that be true?

J. C. CORBIN.

By PROF. COOPER D. SCHEMITT, *Charlottesville, Va.*

The hemispheres are 24 inches in diameter, and hence present a surface of $24^2 \times .7854 = 452.3904$ sq. in., and as the pressure of the atmosphere is 15 lbs. to the square inch, the entire pressure is $452.3904 \times 15 = 6785$ lbs. I do not suppose 30 horses would have much difficulty in overcoming the pressure.

By GEO. C. RUSSELL, *San Francisco, Cal.*

We have $(24^2 \times .7854 \times 15) \div 15 = 452.856$ lbs. for each horse to pull in separating the hemispheres.

854. A, B, and C having 4 loaves for which A paid 5c., B 8c., and C 11c., eat 3 loaves and sell the fourth to D for 24 cents. Divide the 24c. equitably.

L. A. M.

By J. C. GREGG, *Brazil, Ind.*

They gain 18 cents, of which A gets $\frac{5}{14}$ of 18 cents, less 1 cent for bread eaten, or $2\frac{3}{7}$ cents. B gets $\frac{8}{14}$ of 18 cents, plus 2 cents for bread not eaten, or 8 cents. C gets $\frac{11}{14}$ of 18 cents, plus 5 cents, or $13\frac{1}{2}$ cents.

855. A drover paid \$76 for calves and sheep, \$3 for calves and \$2 for sheep; he sold $\frac{1}{4}$ of the calves and $\frac{2}{5}$ of the sheep for \$23; and in so doing lost 8% on their cost; how many of each did he purchase?

A. M. SCRIPTURE.

By GEO. C. RUSSELL, *San Francisco, Cal.*

The cost of $\frac{1}{4}$ of the calves and $\frac{2}{5}$ of the sheep is $\$23 \div .92 = \25 . Multiply by 4, the cost of the calves and $\frac{8}{5}$ of sheep equals \$100: $\therefore \$100 - \$76 = \$24$, must be $\frac{8}{5} - \frac{5}{5}$, or $\frac{3}{5}$ of the cost of the sheep, and the sheep cost $\$24 \div \frac{3}{5} = \40 ; the calves cost $\$76 - \$40 = \$36$. There were $40 \div 2 = 20$ sheep and $36 \div 3 = 12$ calves.

Problems for Solution.

367. By W. C. BINKLEY, *Cincinnati, Ohio*.—"A gentleman proposes to plant a vineyard of 10 acres. If he places the vines 6 feet apart, how many more can he plant by setting them in the quincunz order than in the square order, allowing the plat to lie in the form of a square, and no vine to be set nearer its edge than 1 foot in either case?"

368. By L. A. REED, *Cleveland, Ohio*. -Find the volume generated by the revolution of a circle on a tangent.

369. By N. B. WEBSTER, *Yonkers, N. Y.* -A tract of land of triangular form is bounded on one side, for the distance of two miles, by a straight road. The measurement of the other sides is impossible on account of impassible swamps. The corners and bearings of the tract being known, I cut off a portion of it from the vertex opposite the road, by a line 15 chains long having the direction of the road, and find the other sides of the part cut off to be respectively 13 and 14 chains. How many acres in the whole tract?

370. By A. G. GUNDER, *Spartanburg, Ind.* -Two boys run in opposite directions round a rectangular field whose area is 1 acre. They start from one corner and meet 13 yds. from the opposite corner; and the rate of one is $\frac{5}{8}$ the rate of the other. Determine the dimensions of the field.

371. By W. C. MENDENHALL, *West Manchester, O.* -What is the solidity of the middle frustrum of an oblate spheroid, the middle diameter being 45, that of either end 30, and the length 15?

372. By E. P. CLEMENS, *Spartanburg, Ind.* -What is the length of a pendulum that shall vibrate just 3 times a second?

373. By D. W. K. MARTIN, *Versailles, Ohio*. -Given two sides of a triangle to be 12 and 8 respectively, and the included angle $\frac{1}{2}$ of the angle opposite the greater side; to find the remaining side.

374. By J. B. SANDERS, *Cambridge City, Ind.* -Taking any scalene triangle, construct another equivalent to it, but *equilateral*.

375. By N. R. OLIVER, M. D. *Dorchester, Ontario, Can.* -Required the area of a square, its side is equal to the sum of the two digits which express its perimeter, and if 6 be added to its area, the sum will be equal to the perimeter inverted?

376. By J. C. ROEBUCK, *Rock Falls, Iowa*. -A 2-inch hole is bored in a wet board 5 inches square. What will be the size of the hole when it has dried $5\frac{1}{2}\%$?

377. By B. J. TOTTE, *New Wilmington, Pa.* -What must be the shape of a vertical pillar that it may appear of the same breadth all the way up to a spectator in a given position?

378. By D. H. DAVISON, *Minonk, Ill.* -A and B husk a field of corn for \$20. When they husk five rows at a time. A husks three standing rows, while B husks the down row and one standing row; when they husk six rows at a time, B husks three standing rows, while A husks the down row and the other two standing rows. How must they share the money? Two-elevenths of the rows in the field were down rows, what was it worth to husk them; and what to husk the standing rows?

379. By MARTIN RICE, *Lone Jack, Mo.* -When Bascom kept grocery at the corners he bought a barrel (44 gallons) of whisky, 50 per cent pure alcohol. He drew out a jug full, as he said, for medical purposes, and then filled up the barrel with water. He next drew out another, same size, for the especial use of himself and Nasby, and filled up with water again; and then continued to draw out jug full after jug full for his customers filling up each time, till he had drawn out 42 times, when a meddling inspector came along and upon examination he found that the liquid in the barrel contained only 2% alcohol. The question now is, how large was that jug, and what were his profits, if he bought at \$1.50 a gallon and sold for 40 cents a pint.

Solutions should be received on or before April 13.

Examination Questions.

ARITHMETIC.

1. A grocer sold raisins at 22 cents per pound and gained 10%: what per cent would he have gained if he had sold them at 24 cents per pound?

Ans.—The cost is $22 \div 1.10 = 20$ cents; the required rate is $4 \times 100 \div 20 = 20\%$.

2. Divide \$79 among three men, A, B and C, so that A's share shall be to B's share as 2 to 3, and B's share to C's as 4 to 5.

Ans.—Let C's share be 15, B's $\frac{4}{5}$ of 15, or 12, and A's $\frac{2}{3}$ of twelve, or 8 parts; hence their shares are as 8, 12, and 15, or A gets \$16, B \$24, and C \$30.

3. Express in figures the following: Two hundred and fifty-four thousand seven hundred and sixty-three thousandths.

Ans.—254.763.

4. Sent \$1,000 to buy a carriage; commission, $2\frac{1}{2}$ per cent; what must the carriage cost?

Ans.—It must cost $\$1000 \div 1.02\frac{1}{2} = \975.609 .

5. A field 40 rods on one side, contains 2 acres. What per cent of the length is the width?

Ans.—The width is $(160 \times 2) \div 40 = 8$ rods; $8 \times 100 \div 40 = 20\%$.

6. The sides of a certain trapezium measures 10, 12, 14 and 16 rds. respectively, and the diagonal, which forms a triangle with the first two sides, is 18 rods, what is the area?

Ans.—The diagonal divides the trapezium into two triangles whose sides are 10, 12, 18 and 14, 16, 18, and whose areas are 56.568 and 107.328, respectively. Hence area required is $56.568 + 107.328 = 163.896$ sq. rds.

7. (a) Divide 6 and $\frac{2}{3}$ by .08; (b) Divide 16 and $\frac{2}{3}$ by .033 and $\frac{1}{3}$; (c) Divide 279 by 155 millionths, and multiply the quotient by 15 ten-thousandths.

Ans.—(a) 80. (b) 500. (c) 2700.

8. How do you find the per cent of daily attendance in your school? What is the face of a note which yields \$115.80 when discounted at bank for 90 days at 6 per cent?

Ans.—Multiply the average daily attendance by 100 and divide by the average monthly enrollment. The face of note must be $\$115.80 \div .9845 = \117.62 .

9. At 20 cents per square foot of surface, find the cost of a stove-pipe 16 feet long and 7 inches in diameter.

Ans.—The cost is $\frac{7}{12} \times \frac{3\frac{1}{2}}{12} \times 16 \times .20 = \5.86 .

10. How much currency is required to purchase United States 5% bonds, interest payable in gold, to yield an income of \$544 in currency when gold is at 36% premium; the broker's commission being $\frac{1}{4}\%$ in currency on the par value of the bonds?

Ans.—Income in gold is $\$544 \div 1.36 = \400 , and the face of bonds is $\$400 \div .95 = \8000 . Hence the cost is $\$8000 \times 1.00\frac{1}{4} = \8020 .

1. If six pipes fill a vessel in $3\frac{3}{4}$ hours, how many of the same size will be required to fill it in $\frac{1}{10}$ of an hour?

Ans.—If it requires 6 pipes to fill a vessel in $3\frac{3}{4}$ or $\frac{15}{4}$ of an hour, to fill it in $\frac{1}{10}$ of an hour, it will take $36 \times 6 = 216$ pipes.

2. If 15 men cut 11 cords of wood in 5 days, how many men will cut 33 cords in 9 days?

Ans.—To cut 33 cords or three times as much, it will take $3 \times 15 = 45$ men, by working 5 days, but to work 9 days it will require $\frac{9}{5}$ of $45 = 25$ men.

3. Three circles, each 40 rods in diameter, touch each other externally, what is the area of the space enclosed between the circles?

Ans.—The lines joining the centers of three circles form an equilateral triangle, whose side is 40 rd. and area, $20^2 \times \sqrt{3} = 692.8$ sq. rd. Each angle of an equilateral triangle is 60° , hence each sector of a circle in the triangle is $\frac{60}{360}$, or $\frac{1}{6}$ of a circle, whose radius is 20 rd. Area of three sectors is $20^2 \times 3.1416 \times \frac{1}{6} \times 3 = 628.3$ sq. rds. Hence the part enclosed is $692.8 - 628.3 = 64.5$ sq. rd.

4. A mechanic lost 20% on the cost of a wagon by selling it for \$40; for what should he have sold it to gain 30%?

Ans.—The cost is $\$40 \div .80 = \50 , and required selling price $\$50 \times 1.30 = \65 .

5. A, B and C are partners: A's stock is \$5760; B's \$7200; their gain is \$3920, of which C has \$1120. Find C's stock in A's and B's gain.

Ans.—C's gain is $\frac{2}{5}$ of the whole gain, and he owns $\frac{2}{5}$ of the stock. A and B own $\frac{3}{5}$ of stock, and C's is therefore $\frac{2}{5}$ of $(\$5760 + \$7200) = \$5184$. A and B gain $\$3920 - \$1120 = \$2800$, which, divided in proportion of their stock, or as 4 to 5, gives A's gain $\frac{4}{9}$ of $\$2800 = \$1244\frac{4}{9}$, and B's $\frac{5}{9}$ of $\$2800 = \$1555\frac{5}{9}$.

6. How many square inches in one face of a cube which contains 2,571,353 cubic inches?

Ans.—One edge of cube is $\sqrt[3]{2571353} = 137$, and the area of one face is $137^2 = 18769$.

7. A building, 65 ft. by 44 ft. has a foundation wall 12 ft. deep and 2 ft. thick. Find the number of cubic feet in the wall.

Ans.—The length of wall is $65 \times 2 + 40 \times 2 = 210$ ft.; $\therefore 210 \times 12 \times 2 = 5040$ cu. ft.

8. If I pay for a pound of sugar and get a pound Troy, what per cent do I lose and what per cent does the grocer gain by the transaction?

Ans.—The difference in weight is $7000 - 5750 = 1250$ gr.; I lose $1250 \times 100 \div 7000 = 17\frac{3}{4}\%$ and the grocer gains $1250 \times 100 \div 5750 = 21\frac{4}{5}\%$. (This should be the answer to 4th question, p. 35, Feb. Visitor).

9. A and B do a piece of work in 12 days, B and C in 9 days, and A and C in 6 days; how long will it take each alone to do it?

Ans.—Together they do $\frac{1}{12}$ of $(\frac{1}{12} + \frac{1}{9} + \frac{1}{6}) = \frac{1}{3}$ of the work in a day. A does $\frac{1}{3} - \frac{1}{9} = \frac{2}{9}$ in a day, or the whole work in $14\frac{1}{2}$ days; B does $\frac{1}{3} - \frac{1}{6} = \frac{1}{6}$ in a day, and it will take him 72 days alone; C does $\frac{1}{3} - \frac{1}{12} = \frac{1}{4}$ in a day, or all of it in $10\frac{1}{2}$ days.

10. A man bought a farm for \$3500, to be paid in 4 years, with annual interest at 6 per cent, but failed to pay the interest; what was due at the close of the fourth year?

Ans.—Simple interest is $\$3500 \times .24 = \840 ; interest on annual interest is $\$210 \times .06 \times (3 + 2 + 1) = \75.60 ; hence $\$3500 + \$840 + \$75.60 = \4415.60 is the amount due.

HISTORY.

1. Define history of United States?

ANS.—The recorded events from the earliest discoveries and settlements to the present time. Our history properly commences with the period when the thirteen North American colonies of Great Britain threw off their allegiance to the mother country and established themselves as an independent nation.

2. Who were the "Sons of Liberty?" Give an account of the action of that body.

ANS. Numerous societies were formed in 1765, especially in N. Y., Conn., and Mass., of those who were determined to combine in resisting the oppressive law. They called themselves "Sons of Liberty." Oct. 7, delegates from these societies in nine of the colonies formed a national compact, known as the first colonial Congress. They sat for three weeks and Timothy Ruggles, the noted patriot of Mass., was president. They agreed upon a "Declaration of Rights," and framed a petition to the King and Parliament.

3. What were the Mecklenburg Resolutions?

ANS. They were the prelude to the Declaration of Independence. The patriots of Mecklenburg Co., N. C., chiefly Presbyterians of Scotch-Irish descent, met at Charlotte, May 31, 1775, and renounced their allegiance to King and Parliament.

4. During whose administration was the War of 1812? The Mexican War? The Civil War?

ANS.—(a) Madison's. (b) Polk's. (c) Lincoln's.

5. Describe "Perry's Victory" and "Custer's Last Fight."

ANS.—The Battle occurred Sept. 10, 1813, it was severe, and the *Lawrence*, having fought two of the British squadrons at once was riddled and shattered. Perry, seizing his flag sprang into a boat and was rowed to the *Niagara*, whence he ordered a fresh onset upon the enemy's line. He won a complete victory, and went back to the sinking *Lawrence* to receive the surrender upon her deck. Then he wrote to General Harrison: "We have met the enemy and they are ours,—two ships, two brigs, one schooner, and one sloop."

This occurred June 25, 1876. A large detachment of the army was sent to subdue the Sioux Indians, while Gen. Custer, with the Seventh Cavalry, was reconnoitering near the Little Big Horn River, in Montana, when he suddenly came upon the Indians in full force. A battle followed in which the *Custer*, with every man of his command, was slain.

6. Who were the Hessians?

ANS.—They were men from the petty German provinces hired by England to aid in the Revolutionary War, at \$36 per head. Over 17,000 were engaged, and they were greatly feared in America, because of their cruelty.

7. What rendered Tyler's administration unpopular?

ANS.—On the question of re-chartering a National Bank. President Tyler was in violent opposition to his party. Twice a bill for that purpose was passed by Congress, and twice it was vetoed by the president. All his cabinet resigned except Webster. Tyler vetoed five bills in less than eighteen months.

8. What State has produced the most Presidents? Name the Presidents elected from Ohio.

ANS.—(a) Virginia. (b) Hays and Garfield.

9. When was West Virginia admitted into the Union? What caused the separation from Virginia?

ANS.—(a) June 20, 1863. (b) In that part of Va. west of the Alleghanies, a majority of the people were attached to the Union, and therefore became a separate state.

10. What was the Webster-Ashburton Treaty?

Ans.—This treaty (1842) disposed of two long vexed questions between the U. S. and England. The north-eastern boundary line of the U. S. was fixed where it still remains; the "right of search" was renounced; and the two nations agreed upon the suppression of the slave trade.

1. How do you teach history?

Ans.—In teaching the *elements* of history we should begin at home, and make biography the basis throughout the course. Historic facts should be given in connection with lessons in geography. The pupils may become familiar with Columbus and his voyages, John Smith and his adventures, Pocahontas and her touching fate, Hudson, Standish, Williams, Penn, Washington, Jefferson, Lincoln, Grant, Lee, Sherman, and a host of men around whom cluster so many historic events, even before a text-book is used. In advanced history a first-class text-book should be used—systematic, clear, and striking in its narratives. The subject should be taken up by epochs, and the events should be made to move before the mind of the learner like the scenes of a panorama. Outlines or mere dry statements of historical facts is not the thing.

2. How many and what States seceded during the civil war?

Ans.—S. C., Dec. 20, 1860; Miss., Jan. 9, 1861; Fla. and Ala., Jan. 11; Ga., Jan. 19; La., Jan. 26; Texas, Feb. 1; Va., April 17; Tenn., May 6, by convention ratified by the people in June; Ark., May 6; N. C. May 21.

3. Where and under what circumstances was the first gun of the civil war fired?

Ans.—On Morris Island, two miles below Ft. Sumpter, the first gun was fired Jan. 9, 1861, by authority of South Carolina, upon the *Star of the West*, which was loaded with supplies and re-inforcements for Ft. Sumpter. On the 12th Edmund Ruffin fired the first gun upon Ft. Sumpter.

4. What was the cause of Dorr's Rebellion?

Ans.—The dissatisfaction of a large party in opposition to the charter government. They wished to abolish the property qualification for voters, and to get possession of the state government under a popular constitution. Thos. H. Dorr was elected Governor by this party, but Gov. King soon suppressed the rebellion.

5. Name some of the most prominent men of colonial times.

Ans.—Cotton and Increase Mather, Jonathan Edwards, John Eliot, John Woolman, John Smith, Lord Delaware, Lord Baltimore, Henry Hudson, Miles Standish, Roger Williams, etc.

6. In what ways have the U. S. acquired territory?

Ans.—By purchase and by conquest.

7. Give a brief history of the U. S. Bank.

Ans.—In February, 1791, upon recommendation of Hamilton, Congress passed an act establishing a U. S. Bank. Its charter was to run 20 years, and in 1811 it was not re-chartered, being lost by one vote in the House and the casting vote of the Vice-President in the Senate. In April 1816, a second U. S. Bank was chartered for 25 years. Jackson ordered the funds to be withdrawn in 1833, in opposition to many statesmen, and this opposition played an important part in the politics of 1854. The deposits of the U. S. were made in certain State Banks which became known as *Pet Banks*. The U. S. Bank expired by limitation in 1836, but it was afterwards chartered by Pennsylvania as a state bank, but in 1841 this bank was suspended. It had \$35,000,000 capital, half of which was held by Europe, and some was held by the U. S. The old directors used the funds in speculation, and its credit was thus impaired.

8. What is the Monroe Doctrine?

Ans.—In the language of John Quincy Adams, then Secretary of State, the

President's message announced that "the American continents, by the free and independent position they have assumed and maintained, are henceforth not to be considered subjects for future colonization by any European power."

9. Name ten different administrations and give some important event connected with each.

Ans.—See text-book.

10. When was the Constitution of the U. S. adopted?

The convention adopted it Sept. 17, 1787, signed by all the members except sixteen. The following states then ratified it in order: Del., Dec. 7, 1787; Pa., Dec. 12; N. J., Dec. 18; Ga., Jan. 2, 1788; Conn., Jan. 9; Mass., Feb. 7; Md., April 28; S. C., May 23; N. H., June 21, and made the proposed government a fact; Va., June 26; N. Y., July 26; N. C., Nov. 21, 1789; R. I., May 29, 1790.

It was to go into operation, according to the provisions of the Convention, on the 4th of March, 1789. The new Congress was to meet in New York on that day, but no quorum arrived until the 30th, and the electoral vote was not counted until April 6. Washington was at Mt. Vernon when the messenger came announcing his election. In a few days he started on his journey to New York, which was a continual ovation, and his progress so slow that he did not arrive until the latter part of the month, which accounts for his late inauguration.

ORTHOGRAPHY.

1. What is orthography?

Ans.—It is the art of writing words correctly and treats of the nature and properties of letters.

2. What is spelling?

Ans.—Naming or writing the letters of a word.

3. What is reading?

Ans.—Reading as a branch of study, is the art of giving proper expression to thought and sentiment.

4. What is the power of a letter as distinguished from its name?

Ans.—Its sound in a word.

5. What is the base of a syllable?

Ans.—Its vowel sound.

6. Define prefix, suffix, affix.

Ans.—A prefix is a letter or letters placed before, and a suffix after, a primitive or compound word to modify its meaning. An affix is either a prefix or a suffix.

7. Write ten words having *a* for a prefix.

Ans.—Ablaze, attire, acephalous, avert, avocation, avulsion, aback, abreast, abroad, ahead.

8. From the following words form other words by adding the termination *ing*: die, hie, tie, vie, hoe, ehoe, dye.

Ans.—Dying, hying, tying, vying, hoeing, shoeing, dyeing.

9. Form words by adding the termination *able* to the following words: charge, sale, sue, peace, change.

Ans.—Chargeable, salable, suable, peaceable, changeable.

10. What are words of one, two, three, four or more syllables called?

Ans.—Monosyllables, dissyllables, trisyllables, polysyllables.

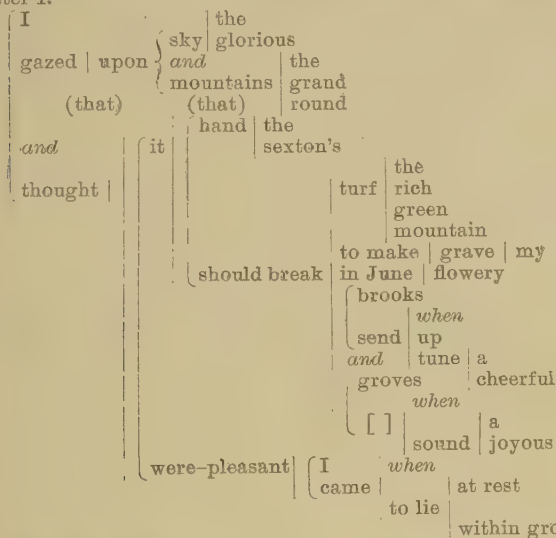
Pannier, paralyzing, novice, marchioness, pyrotechnics, debris, navvete, scarlatina, peripneumony, sunac, stoup, ricochet, caisson, mnemonic, subtle, coalesce, starveling, bedouin, palaver, syzygy.

GRAMMAR.

I gazed upon the glorious *sky*,
 And the grand *mountains round*,
 And *thought that* when I came to lie
 At rest within the ground,
 'T were pleasant, that *in* flowery June,
 When brooks send *up* a cheerful *tune*,
 And *groves* a joyous *sound*,
 The sexton's *hand*, my grave to make
 The rich green *mountain turf* should break. — *Bryant*.

Give three rules for capitalization that apply to this stanza, name all the adjectives, all the prepositional phrases, all the adverbial phrases, parse italicized words and diagram.

Ans.—(1) First word of every line in poetry. (2) Name of month. (3) The letter I.



First *that* is a conjunction and connects all that follows (adverbial clause) to *thought*. Second *that* is a conjunction and joins the appositive clause to *it*. *Round* is an adjective limiting *mountains* in the sense of position, not form. *Thought* is an intransitive verb. *It* may be regarded an expletive and the appositive clause taken as the subject of *were*.

1. Write a sentence having a subject element of the third class.

Ans.—Who the young lady was, became a subject of inquiry.

2. Write two simple sentences; combine them into a complex, then into a compound sentence.

Ans.—He came to Greenville. He was thoroughly examined. When he came to Greenville he was thoroughly examined. He came to Greenville and he was thoroughly examined.

3. How does analysis differ from parsing?

Ans.—Analysis refers to the elements of sentences and parsing to the syntax of words.

4. When a verb has two subjects differing in person and number, how are these subjects arranged, and with which should the verb agree?

Ans.—Second, third and first, the verb agreeing with the one nearest it.

5. To what are conjunctive adverbs equivalent? Illustrate.

Ans.—We can not find an equivalent, for a relative pronoun is not a conjunctive adverb; though by usage a conjunctive adverb may join an adjective clause to some noun; as, I came to a place *where* there were many skulls.

6. Give the principal parts of set, sit, seethe, lay, and lie, (to recline).

Ans.—Set, set, set; sit sat, sat; seethe, seethed, seethed or sodden; lay, laid, laid; lie, lay, lain.

7. What is a figure of speech? Write a short sentence using a simile.

Ans.—A mode of expression in which the ordinary form, construction or application of words is changed. Laws are *like cobwebs*, which catch small flies, but let wasps and hornets through.

8. Give a synopsis of the verb *have* in the third person, singular, indicative mode.

Ans.—He has; he has had; he had; he had had; he will have; he will have had.

9. Parse words in italic in "10."

Ans.—*Deeply* is an adverb, modifying *buried*.

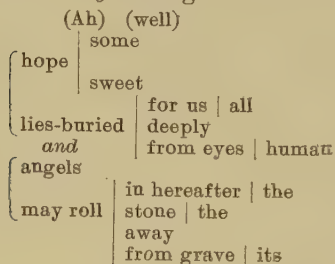
Buried is a perfect participle, with the construction of an adjection, in the predicate with *lies*.

Hereafter is a noun, object of *in*.

May roll is a verb, having *angels* for its subject.

Away is an adverb; it modifies *may roll*.

10. Ah, well! for us all some sweet hope lies *deeply buried* from human eyes; and in the *hereafter*, angels *may roll* the stone from its grave *away*. Diagram the above.



GEOGRAPHY.

1. Give the northern and southern boundaries of the United States.

Ans.—See text-book.

2. Define climate and name the conditions upon which climate depends.

Ans.—Climate is the condition of the atmosphere as regards heat and moisture, and depends upon latitude, elevation, prevalent winds, vicinity of the sea, influence of oceanic currents, nature of soil, and amount of rain.

3. Give the government of Austria, Italy, Brazil, Denmark, and Turkey.

Ans.—Turkey is an absolute monarchy; others limited.

4. Assign your reason why the days are longer in June than in December in this latitude.

Ans.—Because the northern hemisphere is turned towards the sun, and the sun remains longer above the horizon.

5. Where and for what are the following noted? Corsica, St. Helena, Waterloo, Gibraltar and Genoa?

Ans.—*Corsica*, a French province, is noted as the birth-place of Napoleon and Paoli. *St. Helena*, belonging to Great Britain, was the prison-house in which Napoleon spent his last days. *Waterloo*, a village of Belgium 9 miles from Brussels, is famous for the victory of the allied armies, commanded by the Duke of Wellington over the French commanded by Napoleon, June 18, 1815. *Gibraltar* is a town and strongly fortified rock at the southern extremity of Spain, belonging to Great Britain. Near the point of junction of this peninsula with the mainland are the Spanish lines, between which and the rock is a space called the "Neutral Ground." The English obtained this "Key to the Mediterranean" by conquest in 1704. *Genoa* is a famous fortified city of Northern Italy. Its origin it is said is more remote than that of Rome. About the middle of the 13th century it became famous in Italian history in its rivalry with Venice. Columbus was born at Genoa.

6. What are monsoons? Describe them.

Ans.—They are deflected trade-winds, blowing part of the year in one direction and part in the opposite one. They are found in the Indian Ocean, along the coast of Upper Guinea, and in the Caribbean Sea and Gulf of Mexico. The change in the direction of these trade winds is caused by the successive heating of the land on either side of the equator, as the sun passes from one tropic to the other.

7. Which is better adapted to commercial pursuits, Europe or South America? Why?

Ans.—Europe on account of its articulated coasts.

8. Locate Mt. Vesuvius. Describe the most remarkable event in the history of that mountain.

Ans.—It is located on the east side of the Bay of Naples in Italy, and noted for its violent eruptions. In 79 Herculaneum and Pompeii were covered over with ashes to the depth of nearly a hundred feet.

9. Name the five "Great Powers of Europe," and locate the capital of each.

Ans.—England, London; Germany, Berlin; France, Paris; Russia, St. Petersburg; Austria, Vienna.

10. Name five rivers that empty into the Arctic ocean.

Ans.—Genesee, Obi, Lena, Mackenzie and Petchora.

1. Name the political divisions of South America.

2. Between what parallels of latitude is North America? The U. S.

Ans.—North America, exclusive of Central America, extends from the 16th parallel to the Arctic Ocean. The U. S. between 24°30' and 49°.

3. What continents, grand divisions and islands are crossed by the Equator?

4. Name the counties of Ohio that border on Lake Erie.

Ans.—Williams, Fulton, Lucas, Ottawa, Erie, Lorain, Cuyahoga, Lake, and Ashtabula.

5. What is the longitude and latitude of Greenville?

ANS.—About $40^{\circ}4'$ N. and $84^{\circ}40'$ W.

6. Give the area in square miles of each of the Grand Divisions.

7. What is meant by Mean Annual Temperature, Isothermal Lines, Snow Line, and Line of Permanent Ground Frost?

ANS.—Average temperature from observations at brief intervals. Lines passing through places having the same average temperature. Snow line bounds the regions of perpetual snow, and the last is the limit where the frost never thaws out of the ground.

8. What states are mostly engaged in manufacturing? In farming? What states produce most corn? Most wheat?

ANS.—(1) Eastern, (2), (3), (4), Central.

9. What and where are the following: Cattegat, Blanco, San Jose, Chihuahua, Falkland?

ANS.—(1) Strait east of Denmark. (2) Cape western S. A. (3) Capital of Costa Rica. (4) Town in Northern Mexico. (5) Islands south of S. A.

10. Where is the Isle of Man?

ANS.—In the Irish Sea.

Editorial Notes.

J. H. Spencer, of Hollansburg, answered first list in History.

Time for solutions of problems 856 to 866 extended to April 1.

The editor was called to Union Co., Pa., on the illness and sudden death of his father, March 4, and returned on the 10th. His father's age was 64 yr. 4 mo. 8 da.

Credits for solutions will be given in next number. They were overlooked in making up the forms. April number will be issued earlier in the month.

We call especial attention to the "ad" of the Bee-Line Railway, in this issue. If you want first-class accommodations, and rapid transportation, get your tickets by the model line. Reclining-chair cars between Dayton and St. Louis, and the finest equipments throughout, with low price of fare. Conductors and train men are always courteous and obliging, and the station agents ready to procure best rates and best accommodations for patrons of their road. We shall speak again of the superior merits of this popular system of railway.

The mathematics in this issue will be found very interesting, and due study of the solutions will enable the ordinary scholar to enjoy a rich mental repast.

Friends write that they can not do without the *Visitor*, and they speak in terms of highest praise of the manner in which its various departments are conducted.

Who will give a solution of Problem 848?

We received some good problems for publication, which will appear soon.

J. F. FINKEL, *North Lewisburg*, W. H. FLACK, *East Liberty*, D. S. POND, *Rochester*, P. C. PALMER, *Smithville*, J. W. PFEIFFER, *Bolivar*, L. L. HASKINS, *Cleveland*, GEO. A. STINE, *Lindsay*, GEO. W. LEAHY, *Marshallville*, J. Q. HELMAN, *Pleasant Hill*, S. R. WILLIAMS, *Anna*, GEO. M. MORRIS, *Rockbridge*, AARON SEITZ, *Harrods*, F. H. RAY, *Pleasant Corners*, T. HARVEY SMITH, *West Brookfield*, WARREN LOY, *Pyrmont*, W. C. MENDENHALL, *West Manchester*, N. J. BRUMBAUGH, *Union*, and others of Ohio outside of Darke county, have sent clubs to the *Visitor* for this year. They will please accept our hearty thanks. Active friends in the county and in other states who have favored us with good clubs, will be mentioned hereafter.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

828. Who is minister to Persia, China, Brazil, Cuba, Russia etc.

Ans.—U. S. Minister resident to Persia is F. H. Winston, of Illinois, since Oct., 1885; salary, \$5000. Envoy and Minister Plenipotentiary to China is Charles Denby, of Indiana, since May, 1885; salary, \$12,000. To Brazil, T. J. Jarvis, of N. C.; salary, \$12,000. To Russia, Geo. V. N. Lothrop, of Michigan; salary, \$17,500. There is no U. S. Minister to Cuba, but to Spain we send J. S. M. Curry, of Va.; salary of \$12,000. Ministers elsewhere include B. W. Hanna to Argentine Confederation; W. R. Roberts to Chili; R. B. Anderson to Denmark; R. M. McLane to France; Geo. H. Pendleton to Germany; E. J. Phelps to Great Britain; J. B. Stallo to Italy; R. B. Hubbard to Japan; M. A. Hopkins to Siberia; Henry R. Jackson to Mexico; C. W. Buck to Peru; E. P. C. Lewis to Portugal; S. S. Cox to Turkey. We have no minister to Austria as two sent have been rejected by Austrian government. N. B. WEBSTER.

835. What became of the sacred vessels in Solomon's temple? W.

Ans.—The vessels were made by Hiram, a widow's son, in the clay ground between Succoth, and Zarthan, and taken from the Temple by Nebuchadnezzar, used by his son Belshazzar at his great feast, and returned to Jerusalem by King Cyrus. See 1st Kings 7-46; Dan. 3-2; Ezra 1-7. DABEE.

The Eastern, Greek, or Byzantine Empire, as variously designated, was governed by effeminate princes until the time of Justinian, 527 of our era, who won back a large part of the lost empire. His famous general Belisarius captured Carthage. Among the treasures of this city were the sacred vessels of the temple at Jerusalem taken by Titus to Rome, and thence carried to Carthage by Genseric. They were now returned to the Cathedral at Jerusalem, and their subsequent fate is unknown. Some think they are in some vault beneath or in the vicinity of the great temple, now the site of the Mosque of Omer, and may yet be brought to light. H. A. WOOD.

In the year 455 A. D., Genseric, the Vandal King, who, in 427, A. D. had taken Carthage and established the Vandal power in Africa, took and pillaged Rome. The following extract is from Mrs. Willard's Universal History, p. 178:

"Private and public wealth, treasures of palaces and churches became the prey of the Vandals. The ornaments of the capitol with the statues of the gods, which, since the introduction of christianity, had not been removed, with the *treasures and vessels of the holy temple of Jerusalem*, which had been brought by Titus, to adorn his triumph, were alike embarked for Carthage; but they were lost on the passage."

Hence the sacred vessels of Solomon's Temple may be at the bottom of the Mediterranean, somewhere in the track of vessels from Rome to Carthage. Possibly modern diving and dredging appliances may restore them to sight and use again. It is known that Titus, at the destruction of Jerusalem, carefully saved and carried to Rome many of the vessels of gold made for Solomon's Temple, which had been carried back after the captivity in Babylon.

N. B. WEBSTER.

836. When was the first anti-slavery society founded in U.S.? U.

Ans.—The first anti-slavery or abolition society in this country was formed April 14, 1775, in Philadelphia. Benj. Franklin was the first president and Benj. Rush, secretary. On the 25th of January, 1785, the second was formed in New York. First president was John Jay, and second, Alexander Hamilton. The Boston Anti-Slavery Society, by Wm. Lloyd Garrison and his co-workers, was formed in January, 1832, and was the first practically aggressive movement for emancipation of the slaves in the United States. N. B. WEBSTER.

NOTE.—The youngest of Garrison's co-workers, Oliver Johnson, still survives and lives in New York. EDITOR.

Ans.—The Pa. Abolition Society was founded in 1775, and continued in existence until slavery was destroyed. The American Anti-Slavery Society was founded in Philadelphia, December, 1833, Arthur Tappan being the first president.

D. W. K. MARTIN.

837. What king of France died of starvation? W.

Ans.—The reign of Charles VII. was a period of shifting and thrilling scenes in French history. Idle, goodnatureed, and apparently destitute of manly ambition, the King seemed incapable of saving his country. His affairs steadily grew more desperate, and the annals of the time record that the King was actually in want of boots, the shoemaker refusing to furnish them until he was paid. Orleans, the last refuge of Charles's party, had offered to surrender. At this critical state of affairs, France was saved by Jeanne Darc, generally known as Joan of Arc or Maid of Orleans. With his rising fortune he later evinced a vigilance no one had supposed him to possess. France advanced in power and awoke to fresh energies. Charles's last days, however, were full of sorrow. He became more the tool of worthless favorites. The dauphin revolted against him, and he was in constant dread of his son's plots. Believing that his son intended to poison him, he at last refused food and died of starvation.

H. A. Wood.

838. Give sketch of the "Maid of Saragossa." I.

Ans.—Augustina, known as the Maid of Saragossa, a Spanish city, died at Ceuta, Spain, in June, 1857, at an advanced age. She was an itinerant seller of cool drinks in Saragossa in her youth, and during the sieges of that place by the French in 1807 and 1809, distinguished herself by her heroic participation in the severest encounters with the enemy. She was called *La Artillera*, from having snatched the matches from the hands of a dying artillery man and discharged the piece at the invaders. For her services she was made sub-lieutenant in the Spanish army and received several decorations. Byron and Wordsworth have sung her praise.

WM. S. DAVIDSON.

839. What garrison once surrendered to a dead man? W.

Ans.—Du Guesclin, constable of France in the reign of Charles V., while besieging the castle of Auvergne, was stricken by death, 1380. The governor of the fortress had promised to surrender on a certain day. At the appointed time, true to his word, he struck his flag, marched out his garrison, and laid the keys of the castle on the hero's coffin.

H. A. Wood.

There is a Spanish legend that in 1099 the invading Moors were defeated at Tolosa, by means of the trick of mounting a dead hero, the *Cid Ruy Diez*, on his well-known horse *Bavieca*, and leading him into battle at the head of a charging column. The complete protecting armor of the times would make such a deed possible without probability of detection, especially as the live Cid had greatly terrified the Moors. Mrs. Hemans thus renders the legend.

"There was knocking that shook the marble floor,
And a voice at the gate which said,
That the Cid Ruy Diez, the Campeador,
Was there in arms arrayed:
And, that with him from the tomb,
Had the Count Gonzalez come
With a host, uprising to aid!
And they came for the buried king that lay
At rest in that ancient fane;
For he must be armed on the battle day,
With them to deliver Spain!
Then the march went sounding on,
And the Moors by noontide sun
Were dust on on Tolosa's plain."

N. B. WEBSTER.

840. Is there a lake of solid ice in the U. S.? If so, where? I.

Ans.—Yes. On Saw Tooth Mountain in California.

J. K. ELLWOOD.

841. What and where are the "Shades of Death"?

I.

Ans.—"Shades of death" is the name applied to a forest of beech woods, traversed by laurel thickets, and broken by steppes of huckleberry bushes, which covers the country of the upper Lehigh in Pennsylvania. W. C. BINKLEY.

842. In Trinity Church Yard, N. Y., is an inscription, "Died, Feb. 19, 1738." What does § mean?

W.

Ans.—The family Bible which belonged to the mother of George Washington has the following entry. See Edward Everett's *Life of Washington*, p. 19. "George Washington, son to Augustine and Mary his wife, was born ye 11th day of February 1734, about ten in the morning." This way of writing dates of events that occurred in Jan., Feb., or March to the 24th, previous to 1752, corresponds to the Feb. 19, 1733, on the tombstone in Trinity Church Yard. The latter means that the date of the event was Feb. 19, 1738 Old Style or March 2, 1839 New Style. The birth of Washington was Feb. 11, 1731 Old Style, or the equivalent date Feb. 22, 1732 New Style.

The year 1752 was the first legal year that ever began on the 1st of January in England or her colonies. Before that date the year began March 25. In 1752 the difference between the Old and the New Style was eleven days. In Russia and Greece the Old Style still prevails. Now the difference would be about thirteen days. In England the 3d of Sept., 1752 was reckoned as the 14th, eleven days being left out of the calendar. Nobody was born, buried or married in England between Sept. 2 and 14, 1752. To prevent ambiguity in dates of Jan., Feb., and part of March, it was customary to write two dates for years, one for Old Style and the other for New Style. N. B. WEBSTER.

843. What poetess has been styled the "Byron of her sex"? W.

Ans.—Mrs. Caroline Elizabeth Norton (1808-1877), one of the three beautiful grand daughters of Richard Brinsley Sheridan, daughters of his son Thomas, who were styled the "Three Graces" of London society in the reign of George IV. She received a superior education and at the age of seventeen commenced her literary career. She wrote *The Dandies' Port* (1825), *The Sorrows of Rosalie* (1829), *The Unflying One*, a version of the Wandering Jew (1831), *A Voice from the Factories* (1836), *Child of the Islands*, addressed to the Prince of Wales (1845), *Aunt Carry's Ballads* (1847), *Stuart of Dunleath* (1851), *Lost and Saved* (1863), *Old Sir Douglas* (1868), *Lady of La Guayre* (1861), and *The Rose of Jericho* (1870). Fluent melody of versification, richness and felicity of language, great tenderness of sentiment, and rhetorical luxuriance of illustration showed that she inherited much of her grandfather's genius. She made an unfortunate marriage in 1827 with Hon. George Norton; and after some years of pretexts on her part and good promises on his, they were divorced in 1836. A year after the death of Mr. Norton in 1875, she was married to Sir W. Stirling Maxwell. She died June 14, 1877. EDITOR.

844. Where and by whom was the first university founded in Germany?

W.

Ans.—At Prague by Charles IV. (Reign 1346-1378). It soon became so famous as to number 7000 students. H. A. WOOD.

845. Who is the acknowledged "King of Fashion"?

R.

Ans.—Charles Frederic North, born in Lincolnshire, England, about 1826. At the age of twenty he went to Paris, and became salesman in the *Maison de Modes*, Gagelin, where he met and became enamored of the dressmaker whom he afterwards married. He is now immensely rich. His chateau at a beautiful town six miles from Paris, is one of the grandest residences in Europe. His stables are in keeping with the rest of his premises. Each horse has a marble basin for his oats and another for his drink. North's great dressmaking establishment in Paris can afford to pay its two head book-keepers \$50,000 a year, and there it is not an unusual thing to receive 2,000,000 francs by one mail. EDITOR.

846. What is known as the era of the "Great Schism"? W.

Ans.—The Great Schism of the Greek and Latin churches was founded by Photius, patriarch of Constantinople. In 867 he called a council at Constantinople, in which he excommunicated the pope and accused the Roman church of heresy. Although he did not consummate the separation between these churches, he created a division which was never healed. W. C. BINKLEY.

The Council of Constance, 1414, was called by Sigismund to reform the church. This was called the era of the "Great Schism." The rivalries of the three existing popes caused great scandal. Eighteen thousand clergymen, including cardinals and bishops, with a vast concourse of the chief vassals of the crown, learned men, knights and ambassadors from the christian powers, were present. The popes were all deposed and a new one, Martin V. was chosen. H. A. WOOD.

847. What circumstances influenced Conrad to spare Weinsburg after he had threatened to destroy it? W.

Ans.—Conrad III. of Swabia, the first emperor under the Hohenstaufen Dynasty, in 1138 made war against Guelphus, Duke of Bavaria, and laid siege to the city of Weinsberg. The women, finding that the town could not possibly hold out long, petitioned the emperor that they might be allowed to depart out of it, carrying their "dearest jewels." Conrad, knowing that they could not convey many of their effects, granted the petition. To his great surprise when the gates were thrown open, the women came out of the place bearing their husbands or nearest relatives on their backs. The emperor was so moved at the sight that he burst into tears, and after extolling the women for their conjugal affection, he gave the men to their wives, and received the duke in his favor. GEO. L. SHANER.

848. Who was known as L' Petit Corporal"? S.

Ans.—Napoleon Bonaparte, on account of his youthful appearance and bravery at the battle of Lodi, 1796, was so called by the French army. G. H. THOMAS.

849. Was the United States ever out of debt? S.

Ans.—In 1835, when the debt was only \$37,513, it might have been paid as there was a surplus revenue at that time. During Jackson's administration, there was a surplus, according to the Eclectic History, of \$37,000,000 in the banks. The debts are as follows:

In 1790...\$75,400,000,	In 1840...\$	3,000,000,	In 1865...\$2,680,600,000,
1800... 82,900,000,	1850... 63,000,000,	1866... 2,773,236,173,	
1810... 53,100,000,	1860... 64,000,000,	1876... 2,480,000,000,	
1820... 91,000'000,	1862... 524,100,000,	1880... 2,120,000,000,	
1830... 8,000,000,	1863... 1,119,800,000,	1885... 1,830,528,623.	
1835... 37,513,	1864... 1,815,700,000,	Highest in 1866.	

J. W. KECKLER.

850. What state voted for Filmore in 1856? MATTIE HARLEMAN?

Ans.—While Mr. Filmore was in Rome he received information that he had been nominated for president by the American or Know-Nothing party. He accepted, but Maryland alone gave him her electoral vote. S. B. KECKLER.

Ans.—In 1856 the popular vote was as follows: Buchanan, 1,838,169, and 19 states with 174 electoral votes; Fremont 1,341,264, and 11 states with 114 electoral votes; Filmore, 874,534 from all the states except S. C. which chose its electors by joint convention of its legislature, but he received only 8 electoral votes from Maryland. E. M. OWENS.

851. Why will the body of a drowned person come to the surface of the water after a time, and why will the firing of a cannon sometimes bring it to the surface? CURIOUS.

Ans.—Because when decomposition begins, gases are formed that distend the body and make it specifically lighter than water. At ordinary temperatures this may be expected in about nine days.

The firing of cannon causes a rarefied atmosphere temporarily over the water, which stirs the body. Sometimes a sudden fall of the barometer an inch or more will cause drowned bodies to rise to the surface before decomposition sets in. A pretty experiment to show the principle may be easily made by any one. Take a wine bottle, fill it with water and drop into it a piece of porous wood, as red oak, into which small nails have been driven till it will barely sink in water. Apply the mouth to the neck of the bottle and "suck" out as much air as possible by axiomatic process. The wood will rise.

N. B. WEBSTER.

852. Describe the purchase of Rhode Island.

Id.

Ans.—Roger Williams being joined by five companions, embarked in a canoe in June 1635, and passing to the western arm of the Narragansett bay, landed at an attractive spot where was a spring of pure water. He chose the place as a site for a new settlement, and in gratitude for his deliverance from many dangers and persecutions, named it *Providence*. He sought to purchase enough for a settlement, but Canonias refused to sell the land and gave it to his friend "to enjoy forever." This grant was made to Williams alone, and constituted him sole proprietor.

GEO. L. SHANER.

Mrs. Anne Hutchinson, a woman of great gifts and independent spirit, an exile from Massachusetts Bay Colony; Wm. Coddington, a former magistrate of that colony; Wm. Aspinwall, John Clarke, and others repaired to the Narragansett country. They bought the beautiful island of Aquiday, afterwards called Rhode Island, for 40 fathoms of white beads, valued at \$5 per fathom.

WM. S. DAVIDSON.

853. Give author of *A little more grape*, Capt. Bragg. ANNIE.

Ans.—In the midst of the action in the battle of Buena Vista, when the result seemed extremely doubtful, and while Taylor was standing beside the battery of Braxton Bragg, the enemy suddenly poured down upon it. Instantly, by order of the chief, Bragg charged his guns with grape and poured them into the Mexicans, who were almost at the muzzles. While the assailants cowered under this terrible hail, Taylor shouted, "A little more grape, Capt. Bragg."

J. W. KECKLER.

854. If a hair is extracted, will another grow in its place? ALBION.

Ans.—Each hair grows from a tiny bulb or papilla, which is an elevation of the cutis at the bottom of a little hollow in the skin. When a hair pulls out, this bulb will produce another if not injured; but when destroyed, it will never grow again.—See *Steele's Physiology*.

FOREST BALES.

855. What were the last words of Jas. A. Garfield? B. F. F.

Ans.—Gen. Swain, who was detailed to watch the first part of the night, thus describes the last scene: "I took a napkin and wiped his forehead, as he usually perspired on awaking. He then said, 'Oh! Swain, this terrible pain! Press your hand on it.' I laid my hand on his chest. He then threw up both hands, and exclaimed, 'Oh! Swain, can't you stop this?' and again, 'Oh! Swain.' These were his last words."

C. A. SEBRING.

856. What county in the Union is circular in form? M. G.

Ans.—Warren County in Tennessee is nearly circular. McMinn is the county seat.

D. W. K. MARTIN.

New Castle Co., Del., is bounded on the N. W. by nearly a quadrant of a circle of 12 mi. radius, having the town of New Castle as its center. Recent surveys have shown the wonderful accuracy of the first surveyors Mason and Dixon in 1768 and 1869.

N. B. WEBSTER.

857. What causes the high tides in the bay of Fundy? S. A.

Ans.—When the progress of the tidal wave is retarded, either by the contraction of the channel or by other causes, what the wave loses in speed it gains in height, from the heaping up of the advancing waters.—*Houston's Physical Geography.*

J. W. KECKLER.

The height of the tide depends upon local circumstances. The high tide in the bay of Fundy, is due to the position of the shores, and the meeting of the tide from the North Atlantic, with the main tide from the South Atlantic.

JOHN FITZGERALD.

858. What is muriatic acid, and how made? Id.

Ans.—Muriatic acid is an old name for hydrochloric acid, sometimes called chlorohydric acid. It is a colorless gas when pure, but fuming in the air. Sometimes it is emitted from volcanoes, but it is practically an artificial product. As commonly used the gas is in solution in water, and the sour water is the commercial and the chemically pure muriatic acid.

It may be made by direct union of equal volumes of its elements, chlorine and hydrogen gases. The mixture of these two gases forms a chemical union by exposure to sunlight, causing thereby an explosion.

It is usually made from mixing and gently heating in retorts common salt and sulphuric acid, the former furnishing the chlorine and the latter the hydrogen. The gas is conducted into cold water which becomes the acid of the query. In like manner aqua ammonia is a solution of the gas, ammonia, in water.

N. B. WEBSTER.

859. Does size of brain determine the power of intellect? Id.

Ans.—In determining the power of intellect two things must be considered; viz., size and quality of brain.

J. H. W. SCHMIDT.

Brown's physiology says, "that the proportion of the gray, as compared with the white matter in the cerebrum," determines the power of intellect.

G. H. THOMAS.

A negro died recently in Columbus, Ohio, aged 45 years, whose brain weighed $68\frac{1}{2}$ oz., nearly 5 oz. more than the famous brain of Cuvier. He was a slave till 1862, and very illiterate.

EDITOR.

860. How do divers work under water? Id.

Ans.—The diver simply puts on a kind of suit made of India-rubber, which completely covers him and keeps out the water. Glass is fixed in the helmet for him to see through. Of course, he must have air to breathe; that is supplied by a hose or tube leading from the inside of his suit, or covering, up to the boat, where the other men are carefully pumping air to him through the hose. His boots have leaden soles, and heavy weights are attached to his suit to enable him to sink. Of course, he does not feel the great weight of the apparatus while he is under water. In such suits men go under the water to examine and repair ships, recover wrecks, sunken treasures, etc.

J. H. W. SCHMIDT.

861. What was the "War of the Meal-sacks"? B. D.

Ans.—In the Holy War, instituted by Mohammed in A. D. 623, to establish the Islam, Abu Sofyan was the great general who conducted the campaign against Mohammed. After the celebrated battle of Bedr, in December, A. D. 623, when Abu Sofyan was returning with his great Syrian caravan, and were attacked by Mohammed with 308 men at the watering place of Bedr, north of Medina, Abu Sofyan summoned 200 fleet horsemen, each with a sack of meal at his saddle-bow, the scanty provision of an Arab for a foray, and sallied forth to Medina. They were hotly pursued by Mohammed and his forces, and in the encounter that took place, these horsemen throw off their meal sacks, and fled precipitately. This has been called the Battle of the Meal Sacks. See *Mohammedanism* in Britannica.

EDITOR.

862. What is meant by *showing the white feather*?

Id.

ANS.—To show the white feather is to turn coward.

J. H. W. SCHMIDT.

There is also another meaning. It is customary among the Indians to add a feather to their head-gear for every enemy they conquer. In one of our Indian wars, a Quaker, who refused to fly, saw a horde of savages approaching his house. He set food before them, and after eating, the chief placed a white feather over the door, which was regarded as a token of friendship and peace, and none ever violated the covenant by injuring the inmates.

EDITOR.

863. What are known as *The Seven Mortal Sins*? *Seven Virtues*? *The Seven Bodies in Alchemy*? *The Seven-Hilled City*?

Id.

ANS.—Pride, wrath, envy, lust, gluttony, avarice and sloth are given in the catalogue of mortal sins as estimated by the ancients.

Faith, hope, charity, temperance, fortitude, prudence and justice, were likewise considered the seven virtues that should adorn and make God-like the human character.

The seven bodies in alchemy are classed as follows: The sun represents gold; the moon, silver; Mars, iron; Mercury, quicksilver; Saturn, lead; Jupiter, tin; and Venus, copper.

Rome was known as *Urbs Septicollis*—Seven-hilled city, because it was built on seven hills, and surrounded by Servius Tullius with a line of fortifications. The Latin names of the seven hills are *Pallatinus*, *Capitolinus*, *Quirinalis*, *Caelius*, *Aventinus*, *Viminalis* and *Esquilinus*. See *Reader's Handbook* by Brewer.

EDITOR.

CREDITS.

ORVAL HYER, *Gettysburg, Ohio*, 835, 836, 849, 850, 855, 856.

CHAS. E. MANN, " " 835-6-49-50-2-5-8.

MABEL HERSHEY, " " 836-8-49-50-2-5-6.

PHEBE SHIVES, *Woodington, Ohio*, 850, 856, 857.C. A. SEBRING, *North Star, Ohio*, 836-49-50-2-5.CHAS. H. BIGLER, *Horatio, Ohio*, 836-50-2.W. C. BINKLEY, P. O. Clerk, *Cincinnati, Ohio*, 837-41-6.FOREST BALES, *North Lewisburg, Ohio*, 835-52-3-4-5-7-9.

B. F. FINKEL, " " 838-49-51-3-5-7.

E. M. OWENS, *German, Ohio*, 838-53-6-9-60.

G. H. THOMAS, " " 835-7-8-48-9-50-3-5-6-9.

M. A. BROWN, " " 836-50-2-6-7.

W. J. WAGNER, *Bakers, Ohio*, 835-7-8-47-50-3-6.JOHN FITZGERALD, *Weavers, Ohio*, 835-6-8-49-50-2-3-6.

S. B. KECKLER, " " 836-50-2-3-6-7-60.

W. S. DAVIDSON, *Lewisburg, Ohio*, 838-41-2-6-9-50-3-5-6-9.WARREN LOY, *Pyrmont, Ohio*, 849-50-2-3-4-6-9-60.J. W. KECKLER, *Hagerman, Ohio*, 849-50-2-3-4-6-9-60.GEO. A. STINE, *Lindsey, Ohio*, 855.HARRY RECHER, *West Sonora, Ohio*, 836-49-62.PROF. H. A. WOOD, A. M., *Cleveland, Ohio*, 835-7-9-42-4-6-7.GEO. L. SHANER, *Stewarts Station, Pa.*, 835-6-8-45-7-8-9-50-51-2-3.J. H. W. SCHMIDT, *Ansonia, Ohio*, 835-6-45-7-8-9-42-4-6-7-8-9-50-1-3-5-6-8-9.N. B. WEBSTER, A. M., *Yonkers, N. Y.*, 835-6-7-8-9-42-4-6-7-8-9-50-1-3-5-6-8-9.D. W. K. MARTIN, *Versailles, Ohio*, 836-8-44-7-9-50-1-2-5-6-7-8-9.J. K. ELLWOOD, Sup't of Schools, *Mauch Chunk, Pa.*, 840-9-50-7-8-9-62.

Our esteemed contributors will please accept our hearty thanks for the interest taken in this department. We trust the excellent queries published monthly will enlist the attention of our friends during the year.

QUERIES.

892. What is meant by *chain navigation*? PREBLE.
893. How was gold discovered in California? Id.
894. Give a sketch of the life of Kit Carson. Id.
895. Describe the Fort Alamo Massacre. Id.
896. What was the Mountain Meadow Massacre? Id.
897. Give incident and name of the only steamboat that went down the Niagara River below the Falls, and over the whirlpool, without loss of life. VAL.
898. What was the treaty with China in 1845? S. B. KECKLER.
899. Who invented phonography? D. W. K. MARTIN.
900. Why are two light woolen garments warmer than one heavy one? Id.
901. Where is "Black Hole of Calcutta." and for what is it noted? Id.
902. By whom was the Constitution of the United States written? Who was known as "The Expounder of the Constitution?" Id.
903. When was the Ballot-Box first used in the U. S.? Id.
904. What do astronomers say of the length of days and nights, and of the seasons of Jupiter? GEO. L. SHANER.
905. Where and what is the Telegraphic Plateau? Why so called. M. A. BROWN.
906. Did Garfield and Arthur get one electoral vote in Cal., 1880? Explain. J. S. HOYMAN.
907. Why is a toper's nose red? W. S. DAVIDSON.
908. At what altitude will water boil at 180° F.? Id.
909. Who was known as the "Hair buying general"? Id.
910. Who first used the "Pocket Veto" and for what? W. F. L. SANDERS.
911. Give names and location of the "pet banks." Id.
912. When and where was the first bank established? The first national bank incorporated? H. A. WOOD.
913. Is a cent the same as a penny? Id.
914. What presidents were elected without a majority of the popular vote. EDITOR.
915. Name three towns in Colorado over 9000 ft. above sea level. G. W. SCHAFER.
916. Who spent 16 years in writing a history and then burned it up? Id.
917. What were the last intelligible words of John B. Gough? F.
918. Who is Laura D. Bridgman? M. R.
919. How was the Greeley Expedition gotten up, and for what purpose? What discoveries were made? R.

Answers should be received on or before April 13.



No. 4.

SOLUTIONS OF PROBLEMS.

H. A. WOOD.

I do not know how Bernoulli solved it.

856. I have a certain number of 3-inch cubes which exactly fill three cubical boxes. The first box contains 217 more than the second, and the second 169 more than the third. How many cubes and what is the size of the boxes?

EDITOR.

S. J. BROWN, J. M. TAYLOR, W. C. BINKLEY,

It is well known that $1^3+6^3+8^3=9^3$ or $217+512=729$; whence $729-217=512$, and $512-169=343$. First will hold 729 3-inch cubes, second 512, and third 343. $\sqrt[3]{(729 \times 27)}=27$ in. size of first box; $\sqrt[3]{(512 \times 27)}=24$ in. size of second box; $\sqrt[3]{(343 \times 27)}=21$ in. size of third box.

A. L. FOOTE, A. M. SCRIPTURE, EDGAR EUBANK, J. C. CORBIN, ALBERT DAVISON.

Let $x-1$, x , and $x+1$ be the sides of three cubes; first we have $x^3-(x^3-3x^2+3x-1)=169 \dots (1)$; and $(x^3+3x^2+3x+1)-x^3=217 \dots (2)$. Subtracting (1) from (2) we have $6x=48$. Whence $x=8$, $x-1=7$, and $x+1=9$. Hence the side of the first box is $3 \times 9=27$ inches, of the second $3 \times 8=24$ inches, and of the third $3 \times 7=21$ inches.

GEO. C. RUSSELL, WM. WILEY, J. W. PFEIFFER, J. K. ELLWOOD.

Let x^3 =side of the third box, and $(x+m)$ =side of second. There will be x^3 blocks in third and $x^3+3x^2m+3xm^2+m^3$ blocks in second. $x^3+3x^2m+3xm^2+m^3-x^3=3x^2m+3xm^2+m^3=169$. Solving for x , we find $x=m \div 2 \pm \frac{1}{2} \sqrt{(676-m^3) \div 3m}$. As the radical must be an integer, we find $m=1$, the only value of m that satisfies this condition. For $m=1$, $x=7$, $x+m=8$; $\sqrt[3]{(8^3+217)}=9$ cubes in side of first box. As each cube is 3 in., the edge of the boxes are 27 in., 24 in., and 21 in., respectively.

D. W. K. MARTIN, *Versailles Ohio.*

Since the second box contains 169 blocks more than the third, we consider that it contains one more layer of blocks on three faces to make it a cube. Then the addition would consist of 3 squares + 3 strips a block wide and of the same length as the squares, + one block at the corner; hence the 3 squares + 3 strips = $169-1=168$ blocks, and 1 square + 1 strip = $\frac{1}{3}$ of $168=56$ blocks. Increase this square on 2 of the sides by a strip $\frac{1}{2}$ the width of a block; but we lack then a corner square whose side is $\frac{1}{2}$ width of a block; hence the square would contain $56+\frac{1}{2}=56.25$; and $\sqrt{56.25}=7.5$ blocks in a side which we increased by a strip $\frac{1}{2}$ the width of a block, then $7.5-.5=7$ blocks in a side of the third box. Then $7^3=343$ blocks, and $\sqrt[3]{(343 \times 3^3)}$ =width of third box = 21 inches. Since the second box contains 169 more blocks than the third, we have $343+169=512$

blocks in the second box, and its side $= \sqrt[3]{(512 \times 3^3)} = 24$ inches. Also if first contains 217 blocks more than the second, we have $512 + 217 = 729$ blocks in the first box, and its side $= \sqrt[3]{(729 \times 3^3)} = 27$ inches. $\therefore$ we have $343 + 512 + 729 = 1584$ blocks.

857. A, B and C mow a field for \$12. A mows as much as B and C, lacking 5 acres, and B as much as A and C, lacking 10 acres. If A receives \$5, how much should B and C receive?
Id.

G. W. LEAHY, WM. KAUFFMAN, J. E. GENSEMER, R. A. LEISY, EDWARD DABE,
W. P. MATHIAS, COOPER D. SCHMITT, A. L. FOOTE, W. C. BINKLEY, J. K.
ELLWOOD, D. W. K. MARTIN, S. P. BARTLET, ARBERT DAVISON, EDGAR EUBANKS.

Since A received \$5 he must have mowed $\frac{1}{2}$ of the field; and because A mowed $\frac{1}{2}$, B and C together must have mowed $\frac{1}{2}$. Now, it is evident that $\frac{1}{2} - \frac{1}{2} = \frac{1}{6} = 5$ acres; and the field contains $5 \div \frac{1}{6} = 30$ acres, of which A mowed $(30 - 5) \div 2 = 12\frac{1}{2}$ acres for \$5, or 40 cents an acre. B mowed $(30 - 10) \div 2 = 10$ acres at 40 cts. = \$4, and C the remaining $7\frac{1}{2}$ acres at same price = \$3.

858. A dealer brought corn at 60 cents, potatoes at 30 cents, and oats at 40 cents per bushel, and pays for all \$1300. He sells $\frac{2}{3}$ of the corn at a gain of 25%, and half the potatoes at an advance of $33\frac{1}{3}\%$, gaining twice as much on the corn as on the potatoes, and on the sale $\frac{2}{3}$ as much as the oats cost. How many bushels of each did he buy?

A. M. SCRIPTURE, *Clinton N. Y.*

$\frac{2}{3}$ of the corn sells for $\frac{2}{3} \times \frac{3}{4} = \frac{1}{2}$ of what the whole cost, and if the other third sells for cost the gain on the whole will be $1 - [\frac{2}{3} \times \frac{3}{4} + \frac{1}{3}] = \frac{1}{6} = 16\frac{2}{3}\%$; $\therefore$ the selling price of corn $= \frac{7}{6} \times $.60 = $.70 per bushel. Similarly, the selling price of the potatoes $= [\frac{1}{2} \times \frac{4}{3}] + \frac{1}{2} \times $.30 = $.35 per bushel. The oats sell at cost. Then 3 bushels, one of each, cost $.60 + $.40 + $.30 = $1.30, and sell for $.70 + $.35 + $.40 = $1.45. Whence gain on the whole $\frac{1}{13\frac{5}{6}}$ of $1300 = $150 = $\frac{2}{3}$ of cost of oats. $150 $\div \frac{2}{3} = $400 = cost of oats, and $400 $\div .40 = 1000 =$ no. bushels of oats; $1300 - $400 = $900 = cost of corn and potatoes. But the gain on the corn = $.10 per bushel, and gain on the potatoes = $.05 per bushel; the whole gain on corn $= \frac{1}{10} \times $150 = $100; whole gain on potatoes $= \frac{5}{10} \times $150 = $50; $100 $\div .10 = 1000 =$ no. bushels corn; $50 $\div .05 = 1000 =$ no. bushels potatoes; 1000 = no. bushels of oats.$$$$$

859. Suppose half-sheets of foolscap paper a foot long, were pasted together at ends, and 25 lines of figures, and 40 figures to the line, were written thereon, how long a strip of paper would be required to hold the number indicated by 4?
Id.

A. M. SCRIPTURE, *Clinton, N. Y.*

Evidently there is a misprint in this problem. Let us take the expression $4^4 = 4^{256} = 16^{128} = 256^64 = 65536^{32} =$

$$4294967296^{16} = 18446744073709551616^8 =$$

$$340282366920938463463374607431768211456^4 =$$

$$115792089237316195423570985008687907853269984 \cdot$$

$$665640564039457584007913129639936^2 =$$

$$134078079299425970995740249982058461274793658205923933777 \cdot$$

$$235614437217640300735469768018742981669034276900318581864 \cdot$$

$$86050853753882811946569946433649006084096 = n, \text{ which is the}$$

number indicated, and would require 155 figures or $\frac{31}{20}$ of a sheet.

But if each sheet is to hold $\frac{1}{1600}$ of the value of this number, we have simply to divide the number by 1000 to find the number of sheets.

If the expression is 4^{4^4} , we have

$$\log 4^{4^4} = \log 4^n = n \times 4 = 808220494230123000976953749041981 \cdot$$

$$181951012698594585635699224740279712525194607969285331643 \cdot$$

$$795436587767505058053965579177701106268576055190204984272 \cdot$$

$$0602990.837760.$$

This is the real logarithm of the number indicated, but what the number is no one can tell, for a person could not write it in a million years and there is not material enough in the world if it were all converted into thin paper, to write it upon.

860. A board in the shape of a trapezoid, is to be divided into two equal parts by sawing it across parallel to the ends. It is 15 feet long, 17 in. wide at one end and 7 in. wide at the other.

JAS. SMITH.

J. K. ELLWOOD, *Mauch Chunk, Pa.*

$DC = 7$ inches, $AB = 17$ inches, $HK = MC = 180$ inches, and $BM = (17 - 7) \div 2 = 5$ inches. Then by similar triangles, $BM : MC :: BH : EH$, or

$$5 : 180 :: 8\frac{1}{2} : (306 = EH).$$

Area $EHB = \frac{1}{2}(306 \times 8\frac{1}{2}) = 1300.5$ sq. in.; area $ABCD =$

$\frac{1}{2}(17 + 7) \times 180 = 2160$ sq. in.; area $BH KC = 1080$ sq. in.;

area $BFHL = 540$ sq. in., and area $EKC = 1300.5 - 1080$

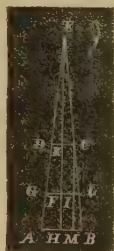
$= 220.5$ sq. in. $1300.5 : 220.5 :: 306^2 : EK^2$, whence

$EK = 126$ inches. The line GL is the dividing line; then area EFL

$= 220.5 + 540 = 760.5$, and we have $220.5 : 760.5 :: 126^2 : EF^2$,

whence $EF = 234$ inches. But $EF - EK = KF$, or the distance from

narrow end is $(234 - 126) \div 12 = 9$ feet, and $15 - 9 = 6$ feet, distance



from narrow end. *GL* represents the line of division of trapezoidal board *ABCD*.

B. F. FINKEL, *North Lewisburg, Ohio.*

The area of the trapezoid is $\frac{1}{2}(7+17) \times 15 \times 12 = 2160$ sq. in.; $2160 \div 2 = 1080 =$ number of inches in each part. $\frac{1}{2}(17^2 + 7^2) = 169$, $\sqrt{169} = 13$ in. = length of dividing line. $\frac{1}{2}(13 + 17) = 15$ in. = average width of larger part of trapezoid. $1080 \div 15 = 72$ in. or 6 ft. = length of short part of trapezoid, and 15 ft. — 6 ft. = 9 ft. = length of long part.

861. A, B and C bought a grindstone 3 feet in diameter and 3 inches thick for \$5; A paid \$2, B, \$1.75 and C, \$1.25. How many inches must each grind off so that he may have the worth of his money; A grinding first, B next, and then C, no allowance being made for loss or wastage. ROYCE'S PROBLEMS.

E. M. OWENS, *German Ohio.*

The area of stone face = $18^2 \times \pi = 324\pi$ sq. in., and B and C pay \$3 for which they get $\frac{2}{3}$ of $324\pi = 194\frac{2}{3}\pi$ sq. in., or $\sqrt{(194\frac{2}{3}\pi \div \pi)} = 13.94$ inches of the radius. $18 - 13.94 = 4.06$ inches of the radius is ground off by A. C grinds off $\frac{1}{4}$ of $324\pi = 81\pi$ sq. in., or $\sqrt{(81\pi \div \pi)} = 9$ in. of the radius. Then 13.94 inches — 9 inches = 4.54 inches of the radius is ground off by B.

By WM. WILEY, *Detroit, Mich.*

C is entitled to $\frac{1}{4}$ the surface; C and B together are entitled to $\frac{6}{10}$ the surface; $\therefore$ C is entitled to $\sqrt{\frac{1}{4}} = \frac{1}{2}$ the radius = 9 in. C and B together are entitled to $\sqrt{\frac{6}{10}} = .7746$ radius = 13.9428; $\therefore$ A grinds off 4.0572 in., B grinds off 4.9428 in., and C the remainder.

862. How many cannon balls 4, 6, or 9 inches in diameter, can be placed in a cubical vessel, 3 feet on a side; and how many gallons of wine will it contain after it is filled with the balls?

G. L. SHANER.

By PROF. COOPER D. SCHMIDT and PROF. J. M. TAYLOR.

Each side of the vessel is 36 inches. Hence its volume is $36^3 = 46656$ cu. in. If the balls be 4 inches in diameter, nine can be placed each way or 729 in all. The volume of each ball is $\frac{4}{3}\pi r^3 = 33.5104$ cu. in., and of the 729, 24429.0816 cu. in. This leaves an empty space of 22226.9184 cu. in. and this divided by 231 will give the number gals. which = 96.65 + gals. Similarly of the second-sized balls there would be 216, the total volume of which is 24429.0816 as before hence same result. Of the third size there would be 64 balls, with the remaining part of the problem the same as above.

REMARK.—This result does not give the *greatest* number of balls that can be put in the box, but it is in accordance with Dr. Edward Brooks, as shown by problem 83, p. 502, Brook's Higher Arithmetic.

J. M. TAYLOR.

863. Paid \$180 for a claim due in six months. A broker bought it on the same day, taking bank discount at 6%. If I cleared \$12.90, what was the amount of the claim?
P. C. PALMER.

J. M. TAYLOR, *Seattle, Wash. T.*

Interest on \$1 for 6 mo. 3 da. is \$.0305; $\$1 - \$.0305 = \$.9695$, proceeds; $\$180 + \$12.90 = \$193.90$; $\$193.90 \div .9695 = \300 .

By S. B. KECKLER, *Weavers, Ohio.*

Let 100% = amount of claim. Then $100\% - \$180 =$ gain on first part of the trade. The bank discount on 100% for 6 months is 3.05% and proceeds, or what he sold for, 96.95%. Hence $100\% - 96.95\% = 3.05\% =$ loss on second part of the trade, and $(100\% - \$180) - 3.05\% = \1390 or $96.95\% = \$193.90$, and $100\% = \$200$.

864. A man walks around a circle with a flag-staff 10 feet long in his hand. If the staff lean out from the vertical 30° , how much farther will the top move than the bottom of the staff in going one round.
Id.

By J. K. ELLWOOD, *Mauch Chunk Pa.*

The staff 10 ft. long is the hypotenuse of a rt. triangle, one of whose acute angles is 30° . By natural sines, we have $1 : 10 :: \frac{1}{2} : x = 5$ ft. Hence the top of staff is 5 ft. away from the circumference of the circle, and describes a circle whose radius is 5 ft. greater than radius of original circle, or whose diameter is 10 ft. greater than diameter of original circle. But the circumference is always πd . Hence $\pi(d+10) - \pi d = 10\pi = 31.416$ ft.

By GEO. NEWBAUER, *Greenville Ohio.*

Since the circumferences of all circles are to each other as their diameters, we may consider the diameter of the circle on which the man walks to be *nothing*, without changing the result. Then the lower end of the staff would turn as on a pivot, and the upper end describing the circumference of a circle. Since the staff leans out 30° , it describes the curved surface of a right cone, whose slant height is 10 ft. and vertical angle $30 \times 2 = 60^\circ$.

Then, since the vertical angle is 60° , the diameter of the base is equal to the slant height, and the circumference or required distance is $10 \times 3.1416 = 31.416$ feet.

865. An agent gets 25 and 5% for cash and 23% for notes on machine sales, and 33 $\frac{1}{4}$ % on repairs sold for cash. After selling repairs listed at 15 for cash and machinery listed at 150, part for cash and part notes, finds that the notes received will balance his account with the company, leaving all the cash for his commission, What was the value of the notes?
ALEX. KNISELY.

By W. P. MATHIAS, Logan, Ohio.

Let $\frac{25}{100}$ of notes = $\frac{57}{30}$ of cash + \$10, and $\frac{1}{100}$ of notes = $\frac{1}{23}$ of $\frac{57}{30}$ of cash + $\frac{1}{23}$ of \$10. $\frac{100}{92}$ of notes = $\frac{285}{92}$ of cash + \$43 $\frac{1}{23}$. $1 + \frac{285}{92}$ of cash = \$150 - 43 $\frac{1}{23}$, or $\frac{377}{92}$ of cash = \$106 $\frac{1}{23}$. $106\frac{1}{23} \div \frac{377}{92} = \$25\frac{75}{377}$ = cash. $150 - 25\frac{75}{377} = \$124\frac{2}{377}$, value of notes.

By EDGAR EUBANKS and ALBERT DAVISON, West Newton, Ohio.

We have 33 $\frac{1}{3}$ % of \$15 = \$5 commission on repairs.

\$15 - \$5 = \$10 amount due the Co. on repairs.

Let 100% = cash on machine sales.

25% of 100% = 25%

5% of (100% - 25%) = 3.75%

25% + 3.75% = 28.75% commission on cash received on machine sales.

\$150 - 100% = amount of notes received,

23% of (\$150 - 100%) = \$34.50 - 23%, com. on notes,

28.75% + \$34.50 - 23% = com. on notes and cash.

But 100% + \$10 = commission on notes and cash,

100% + \$10 = 28.75% + \$34.50 - 23%,

whence 94.25% = \$24.50,

100% = \$25 $\frac{75}{377}$ cash on machine sales,

\$150 - \$25 $\frac{75}{377}$ = \$124 $\frac{2}{377}$, value of notes.

This practical problem "floored" the book-keeper of a general agency, as did Prob. 441. See p. 61, Vol. 4.

866. Four ladies bought a ball of fine thread 3 inches in diameter; what portion of the diameter must each wind off in order to have equal shares of the thread?

ROYER'S PROBLEMS.

By A. L. FOOTE, Merrick, N. Y.

Beginning with the one having the inner portion of the ball, we have for her part 4 : 1 :: 3³ : (1.8898815)³. For the third and fourth lady together we have 2 : 1 :: 3³ : (2.3811017)³. And for the second, third and fourth we have 4 : 3 :: 3³ : (2.7256809)³. ∴ the fourth lady has 1.8898815 inches of the diameter; the second, has 2.7256809 - 2.3811017 = .3445792 inches; the third, 2.3811017 - 1.8898815 = .4912202 inches; and the first, 3 - 2.7256809 = .2743191 inches. PROOF. - .2743191 + .344572 + .4912202 + 1.8898815 = 3 in.

All of the foregoing problems were solved by the following named contributors. A brief biographical sketch of each will appear next month. Messrs. Pfeiffer, Cagwin, Gunder, Pond, Keckler, Schmitt, Brower, Binkley, Ellwood, Thompson, Brown, Davison, Bartlett, Mathias, Corbin, Taylor, and Newbauer.

List of Contributors to this Number.

- J. W. PFEIFFER, *Bolivar, Ohio*, 842-5-6-50-1-2-3-4-5 and 856 to 866.
 S. G. CAGWIN, *New London, N. Y.*, 842-3-5-50-1-2-4-5 and 856 to 866.
 J. C. GREGG, *Brazil, Ind.*, 842-3-5-6-7-9-50-1-4.
 A. L. FOOTE, *Merrick, N. Y.*, 842-4-5-6-7-50-1-2-3-4-5 and 856 to 866.
 WM. WILEY, *Detroit, Mich.*, 842-4-6-7-50-1-2-5 and 856 to 866.
 J. R. BALDWIN, *Blue Grass, Iowa*, 842-4
 A. M. SCRIPTURE, *Clinton, N. Y.*, 842-5-6-7-50-1-2-5 and 856 to 866.
 HENRY GUNDER, *New Castle, Ind.*, 842-3-4, and 856 to 866.
 D. S. POND, *Rochester, Ohio*, 845-7-5-1-2-5 and 856 to 866.
 G. W. LEAHY, *Marshallville, Ohio*, 845-6-7-9-50-1-2-4-5 and 856 to 866.
 R. A. LEISY, " " 845-6-7-9-50-1-2-4-5 and 856 to 866.
 WM. KAUFFMAN, " " 845-6-7-50-1-4-6-7-60-1-3.
 J. E. GENSEMER, " " 846-7-50-1-2-4-5-6-7-60-3-4.
 P. C. PALMER, *Smithville, Ohio*, 845-50-1-5.
 S. B. KECKLER, *Weavers, Ohio*, 845-50-1-2-5 and 856 to 866.
 D. W. K. MARTIN, *Versailles, Ohio*, 845-6-7-50-1-2-5 and 856 to 866.
 COOPER D. SCHMITT, *Charlottesville, Va.*, 845-6-50-1-2-3-4-5 and 856 to 896.
 FOREST BALES, *N. Lewisburg, Ohio*, 845-51.
 B. F. FINKEL, " " 845-6-7-50-1-5 and 856 to 866.
 GEO. C. RUSSELL, *Petaluma, Cal.*, 845-6-7-9-50-1-3-4-5 and 856 to 866.
 GEO. G. BROWER, *Fabery, N. Y.*, 845-6-7-9-50-1-2-5 and 856 to 866.
 W. C. BINKLEY, *Cincinnati, Ohio*, 845-6-7-50-1-5 and 856 to 866.
 J. K. ELLWOOD, *Mauch Chunk, Pa.*, 845-6--7-9-50-1-2-4-5 and 856-866.
 J. W. KECKLER, *Weavers, Ohio*, 845-7-52.
 T. L. BREWER, *Mt. Heron, Ohio*, 845-52.
 MRS. A. J. LILLY, *Dixon, Ill.*, 846.
 M. J. NICOSIN, *Brazil, Ind.*, 847.
 J. M. GREENWOOD, *Kansas City, Mo.*, 848.
 GEO. A. STINE, *Lindsey, Ohio*, 850-8-60-1-6.
 GEO. L. SHANER, *Stewarts Station, Pa.*, 852-62-6.
 MARTIN RICE, *Lone Jack, Mo.*, 856 to 866.
 C. W. THOMPSON, *Kansas City, Mo.*, 856 to 866.
 GRANT SELLER, *West Sonora, Ohio*, 845-6-7-50-1-5.
 S. J. BROWN, *Blanchester, Ohio*, 856 to 866.
 ALBERT DAVISON, *West Newton, Ohio*, 856 to 866.
 EDGAR EUBANKS, *West Newton, Ohio*, 856 to 866 except 859.
 S. P. BARTLETT, *East Dixfield, Me.*, 856 to 866.
 W. P. MATHIAS, *Logan, Ohio*, 856 to 866.
 EDWARD DABE, *Wynant, Ohio*, 856-8-61-2-3.
 J. C. CORBIN, *Pine Pluff, Ark.*, 856 to 866.
 J. M. TAYLOR, *Seattle, Wash. T.*, 856 to 866.
 E. M. OWENS, *German, Ohio*, 856-8-60-1-2-3-4.
 GEO. NEWBAUER, *Greenville, Ohio*, 856 to 866.
 CLINTON LONG, *Versailles, Ohio*, 861.

In the enunciation of Prob. 859, we aimed to say, originally, "to hold the number of figures expressed by the number indicated by 4 raised to a power whose exponent is the 4th power of 4." It would then require a strip of paper over 813 miles long. Mr. Scripture has disposed of the problem very nicely, and we invite attention to his solution on p. 76.

The numerous friends of that eminent contributor Mr. Greenwood, author of Ray's New Higher Arithmetic, will be pleased to see his elegant solution of Prob. 848 on first page of this issue.

Some contributors forget to write only on one side of the paper, to attach the name to each solution, and to leave one line blank between answers, so that they may be cut apart and placed in proper envelopes.

D. H. Davison, civil engineer of Minonk, Ill., J. M. Greenwood, A. M., Sup't of Schools, Kansas City, Mo., J. Monroe Hottel, of Woodstock, Va., C. F. Swisher, Rockford, W. Va., A. M. Scripture, Clinton, N. Y., A. W. Tobias, Graham, Ind., E. P. Clemens, Prin. of U. L. Institute, Spartanburg, Ind., M. J. Nicosin, Brazil, Ind., S. A. Whitsett, Deputy, Ind., Dr. L. A. Mathias, Logan, Ohio, Harvey Smith, West Brookfield, Ohio, Alex. Kuisely, Co. Sup't, Cambridge City, Ind., Geo. C. Russell, Petaluma, Cal., in addition to those mentioned last month have furnished clubs for the *Visitor*, not including those of Darke Co. We tender these friends our most hearty thanks. Next month we will give those in the county. Club rates are as follows: Two new subscribers \$1.50; four new or old \$3; seven for \$5; ten for \$6.50; and fifteen for \$9. A copy free to any one who secures a club of four or more at these rates. Now is the time to introduce the magazine, for teachers ought to take time during the summer for study and for gathering new ideas and general information.

Problems for Solution.

830. How many signals can be made with 3 blue and 2 white flags, which can be displayed either singly, or any number at a time one above another?

COOPER D. SCHMITT.

831. If we saw through $\frac{1}{4}$ of the diameter of a round log, what portion of the cut is made?

GEO. L. SHANER.

832. According to formulæ tabulated for the U. S. Coast and Geodetic Survey, the magnetic declination at Portland, Me., (Lat. $43^{\circ}38.8'$, Long. $70^{\circ}16.6'$) is $13^{\circ}16'$ west, and at Sitka (Lat. $57^{\circ}2.9'$, Long. $135^{\circ}19.7'$) the declination is $28^{\circ}32'$ east. What is the absolute difference of direction of the magnetic needles at these places, each needle supposed horizontal?

PROF. COLMAN BANCROFT, *Hiram, Ohio.*

833. Do you consider the 13th example, page 367, *Ray's New Higher Arithmetic*, a fair question? Please solve.

S. R. WILLIAMS, *Anna, Ohio.*

834. A and B start from the same point and travel in the same direction. A travels 18 mi. a day, and after 9 days turns and travels back as far as B had traveled in 9 days, then turns again and overtakes B in $22\frac{1}{2}$ days after starting. How far does B travel in a day?

C. W. BIGLER, *Gettysburg, Ohio.*

835. How long a period must intervene between conjunctions of all the known primary planets of the Solar System, and by what method of Elementary Arithmetic can the time be most easily computed?

N. B. WEBSTER, A. M., *Yonkers, N. Y.*

836. Prove, when the sum of the hypotenuse and altitude of any right-angled triangle equals the square of the base, that their difference is unity.

MARCELLAS M. THOMPSON, *Clarksburg, W. Va.*

837. Two trees are a certain distance apart; from the top of A to foot of B is 60 feet., from top B to foot A is 40 feet. From the point where these two lines intersect to the plane is 15 feet. What is the height of each tree and the distance apart?

B. F. FINKEL-

838. A man on the bank of a river desires to know the distance to an object on the other side of the stream; how can he find the distance, providing he has nothing but a ten-foot pole?

D. W. K. MARTIN, *Versailles, Ohio.*

839. "If I pay \$1500 for 2 years rent, and \$100 for repairs, how much rent payable quarterly is that equal to, allying 8% interest?"

W. C. BINKLEY.

890. Required the best solution by quadratics of the following:

$$(1) x^3 + y^3 = a \quad (2) x^2 + y^2 = b. \quad \text{J. K. ELLWOOD.}$$

891. Fill a nine square with square numbers such that the sum of the numbers in the large square and each smaller square shall be square numbers.

J. C. ROEBUCK, *Rockfalls, Iowa.*

Solutions should be received on or before May 10.

Examination Questions.

ARITHMETIC.

1. Define evolution, involution, index, exponent, radical.

Ans.—*Evolution* is the process of finding one of the several equal factors of a number. Its symbol is $\sqrt{}$, called the *radical sign*. It was introduced by Stifelius, a German mathematician. It is a modification of the letter *r*, the initial of *radix*, or root. The figure prefixed to the radical sign is the *index* of the root, and denotes the degree of the root to be extracted. *Involution* is the process of forming composite numbers by synthesis of equal factors. The composite number thus formed is called a *power* of that factor. The power is indicated by superiors; as, $5^1=625$. *Descartes* introduced this system of *exponents*.

2. What are the fundamental operations of arithmetic?

Ans.—Addition, Subtraction, Multiplication, and Division.

3. In division of fractions why invert the divisor and then multiply the numerators together, and the denominators together for the numerator and denominator of the quotient?

Ans.—Because the quotient is equal to the product of the dividend by the reciprocal of the divisor. The reciprocal of a number is unity divided by that number. Unity divided by a fraction results in the fraction inverted. Example: $\frac{3}{4} \div \frac{2}{3} = 2$. Analysis: $\frac{1}{3}$ is contained in a unit 3 times, but $\frac{2}{3}$, being three times as much, is contained only $\frac{1}{3}$ of 3 times = $\frac{1}{2}$ times; since $\frac{1}{2}$ is contained in a unit $\frac{3}{2}$ times, in $\frac{2}{3}$ it is contained $\frac{3}{2}$ of $\frac{1}{2} = 2$ times.

4. Reduce $11\frac{3}{4}$ to a simple fraction whose numerator is 517.

Ans.—We have $\frac{47}{4} \times \frac{11}{1} = \frac{517}{4}$.

5. How much can I pay for a note of \$500 drawing interest at 6 per cent, and due in 3 months, that I may get 10 per cent on the investment?

Ans.—The amount of \$500 for 3 mo. at 6%, is \$507.50; $\$507.50 \div 1.025 = \495.12 .

6. A and B perform together $\frac{9}{10}$ of a piece of work in two days, when B leaving, A completes it in one-half day; in what time can each do it alone?

Ans.—A does $\frac{1}{10}$ of the work in $\frac{1}{2}$ of a day, and he will do the whole work in $10 \times \frac{1}{2} = 5$ days; both do $\frac{9}{20}$ in a day, and B $\frac{9}{20} - \frac{1}{10} = \frac{7}{20}$ in a day, or 4 days to do all.

7. A and B engage in trade with different sums of money; A loses 40 per cent of his money, and B gains 67 per cent of his, when their capitals are equal; how much greater was A's capital than B's when they began business?

Ans.—We have 60% of A's = 167% of B's; 1% of A's = $2\frac{1}{6}\%$ of B's and 100% of A's = $278\frac{1}{3}\%$ of B's; hence $278\frac{1}{3}\% - 100\% = 178\frac{1}{3}\%$ is the excess required.

8. An agent sold 50 bushels of wheat for A, and 60 bushels for B, and received \$150 for both lots; if A's wheat is worth 20 per cent more than B's, how much ought each to receive?

Ans.—A's wheat is worth 120% of 50, or 60 bu. of B's; hence their sales are equal in amount and each receives $\frac{1}{2}$ of \$150 = \$75.

9. From $\frac{7}{8}$ of a pound troy, take $\frac{4}{5}$ of an ounce.

Ans.—We have $(\frac{7}{8} \times \frac{1}{2}) - \frac{4}{5} = 9.7$ oz.

10. How many feet of rope 1 inch in diameter would be required to cover a post ten feet high and one foot in diameter?

Ans.—It would take $(10 \times 12) \times (1 \times \pi) = 376.892$ feet.

1. A merchant having marked down his goods $33\frac{1}{3}\%$ from his usual retail price, which was 20% advance on cost, what was the cost of an article now marked 20 cents?

Ans.—His usual retail price was $20 \div .66\frac{2}{3} = 30$ cents, and the cost was $30 \div 1.20 = 25$ cents.

2. At which point does the sun rise first,—at Philadelphia, $75^{\circ}9'23.4''$ W., or St. Louis, $90^{\circ}15'10''$ W.? How much?

Ans.—At Philadelphia, 1 hr. $23\frac{8}{25}$ sec. sooner.

3. Divide 19 hr. $53\frac{3}{7}$ sec. by $7\frac{4}{5}$.

Ans.—2 hr. 26 min. $16\frac{1}{273}$ sec.

4. Find the whole surface of a cylinder; altitude 28 feet and circumference of the base 19 feet.

Ans.—Area of curved surface is $10 \times 28 = 532$ sq. ft.; area of two ends is $(\frac{19}{2})^2 \div \frac{3}{11} \times 2 = 57.455$ sq. ft.; whole area 589.455 sq. ft.

5. In 12 years, I shall be $\frac{2}{3}$ of my present age; how long since was I $\frac{5}{7}$ of my present age?

Ans.—My present age is $12 \div (\frac{2}{3} - \frac{5}{7}) = 30$ yr.; $\frac{2}{3}$ of 30 = 20 yr. the required time.

6. A buys bonds at 20% discount and sells them at 10% premium. What per cent does he gain?

Ans.—He gains $110 - 80 = 30\%$ on the par value and $30 \times 100 \div 80 = 37\frac{1}{2}\%$ on his investment.

7. A and B were playing cards, A lost \$20, which was $\frac{5}{14}$ of the number of dollars B then had more than A; provided this sum was $1\frac{1}{6}$ times as much as A had at first, how much had each when they began to play?

Ans.—A had at first $(20 \div \frac{5}{14}) \div \frac{7}{6} = \48 ; and after playing B had $\$28 + 56 = \84 , and $\$84 - \$20 = \$64$ at first.

8. Find the whole surface of a frustum of a pyramid with slant height, $3\frac{1}{2}$ inches; lower base, 4 inches square; upper base $2\frac{1}{2}$ inches square.

Ans.—Lateral area is $[(16 + 10) \div 2] \times 3\frac{1}{2} = 43\frac{1}{2}$ sq. in.; the basal area is $4^2 + 2\frac{1}{2}^2 = 22\frac{1}{4}$ sq. in.; whole area $65\frac{7}{8}$ sq. in.

9. D's money added to 4 times E's, which is equal to D's, being on interest for 10 years, at 5%, amounted to \$3000. What was each of their fortunes.

Ans.—The amount invested is $\$3000 \div 1.50 = \2000 ; and by the first condition E's investment equals D's investment; hence each invested \$1000, which is D's fortune; E's fortune is $\$1000 \div 4 = \250 .

10. A gave his note to B for \$300, at 10%, due in 4 months; B sells the note the same day to C, at 8% true discount; what does B receive?

Ans.—Amount of note for 4 months at 10% is \$310; present worth of \$310 for 4 months at 8% is $\$310 \div 1.02\frac{2}{3} = \301.948 , which B should receive.

SPELLING.

Benign, conducive, sulky, whisky, handsome, aliment, gummy, guerdon, harangue, halcyon, nonentity, planetary, platter, pleurisy, contaminate, poignant, police, policy, surge, wiry.

HISTORY.

1. Name the plans of operation during the Mexican War.

Ans.—See p. 91 of this issue.

2. Name five Federal Generals of the Civil War. Five Confederate Generals.

Ans.—Grant, Sherman, Sheridan, McClellan, and Meade. Lee, Jackson, Beauregard, Johnston and Bragg.

3. Give an account of Francis Marion; Sam Houston; John Champe.

Ans.—Marion was born in S. C., 1732, and was noted in the Revolution. He carried on a guerilla warfare for three years, when the British took Georgia and besieged Charleston. Houston was born in Va. 1793. He was an adventurer, living with the Cherokee Indians a few years, and was conspicuous in the revolt against the Mexican government by Texas. Champe was born in Va. about 1752. He became noted in 1780, when he was sent by Washington to New York in the guise of deserter, to bring off Arnold in time, if possible, to save Andre. He formed a plan to seize Arnold while walking in his garden, and drag him as a drunken soldier, between two men, to a boat on the Hudson. The plan failed in consequence of Arnold's moving his quarters preceding day.

4. Who was John Davenport?

Ans.—An English puritan and the first minister of New Haven, where he preached about 30 years.

5. What causes led to the Lewis and Clark expedition?

Ans.—This expedition was a pioneer enterprise, designed by Jefferson in the interests not only of geographical science but of territorial acquisition. The government had as yet no claim to the Northwestern portion of the United States. Meriweather Lewis was Jefferson's private secretary and on recommendation of Jefferson, Congress appointed him to conduct the expedition with Capt. Wm. Clarke, and their reports attracted great attention.

6. Give an account of John Brown's life.

Ans.—Born in Conn., 1800, came to Ohio in 1805, worked at the trade of tanner, married Dianthe Lusk 1820, in 1839 conceived the idea of liberating the Southern slaves, removed to Mass. 1846, and emigrated to Kansas 1855, where he was active in the pro-slavery party. In 1859 he called a secret convention of the friends of freedom, who met at Chatham, Can., organized an invasion of Virginia and adopted a constitution. On the night of Oct. 16, 1859, he and about 20 men surprised Harper's Ferry. He was captured the next day by the Va. Militia, and hung at Charlestown, Va., Nov. 2, 1859.

7. What occurred in the following years: 1643; 1853; 1733; 1873; and 1763.

Ans.—See any history.

8. What caused Shay's Rebellion?

Ans.—High taxes, extortions of lawyers in suits for debts, high salaries of officials.

9. Explain fully how members of the President's Cabinet are placed in office.

Ans.—The President appoints and the Senate approves.

10. Give the qualifications necessary for President.

Ans.—Natural born, age 35, resident of U. S. 14 years.

1. Who were the Jesuit Father? What was their mission to America?

Ans.—Leaders of the "Company of Jesus," an order of the Roman Catholic Church, founded by Loyola, a brave nobleman of Spain. Conversion of the natives. See Vol. 6, p. 114.

2. How was Yale College established?

ANS.—By ten Connecticut clergymen, at Saybrook.

3. Give an account of Citizen Genet.

ANS.—Minister of France who came to the U. S. to fit out privateers to prey on English commerce, and recklessly violated U. S. laws.

4. State the financial condition of the government during Jackson's administration; Van Buren's.

ANS.—See p. 68 of last issue.

5. What was the Whisky Rebellion?

ANS.—See Vol. 6, p. 125 and Vol. 5, p. 169.

6. What was the Ostend Manifesto?

ANS.—See Vol. 5, p. 21, for full answer.

7. What was the specie resumption act?

8. What was Grant's Indian Policy?

ANS.—To pay the Indians for claims, and put them all into Indian T.

9. What led to the duel between Hamilton and Burr? Give an account of Burr after this duel.

ANS.—Political differences and Burr's hatred in not getting the support of Hamilton for the presidency. Failure marked his subsequent life. See Feb. No., p. 40.

10. For what was Jefferson noted? Hamilton? Henry? Franklin? Clay?

ANS.—Jefferson as the author of the Declaration, for his wisdom and purity. Hamilton for his statesmanship and great ability as financier. "He smote the rock of public resources, and abundant streams of revenue burst forth." Henry for his remarkable oratory and patriotism. Franklin, as the great American sage, statesman and philosopher. Clay as the peacemaker and able political leader and thinker.

ORTHOGRAPHY.

1. How many elementary sounds in the English language? Classify them and define each class.

ANS.—About 42. Vowels, Subvowels and Aspirates.

2. What is a letter? The name of a letter? The power of a letter? A final letter? A silent letter?

ANS.—A character representing an elementary sound. The name distinguishes the letter as a character, and the power is the sound it represents in a word. A final letter is the last one in a word, and a silent letter represents no sound in a word.

3. What is a coalescent? A labial? Adental? An aspirate? A subvocal?

ANS.—Letter whose sound easily unites with other subvowels or aspirates. They are also called *liquids*. For other definitions see text-book.

4. Of what use are silent letters?

ANS.—To indicate the sound of other letters, and the origin of words.

5. What is a word? A simple word? A compound word? A digraph? A trigraph?

See text-book.

Correct, if necessary: Recussitate, sentusion, Fissure, Censhure, genshen, galiniper, incession, musketo, shurely, translucent.

GEOGRAPHY.

1. Which is farther from the earth's center, the Equator or the Poles? Why?

2. What grand divisions are crossed by the Tropic of Cancer? What grand divisions and islands by the Equator? Tropic of Capricorn?

3. Name, in order of their size, the oceans, grand divisions, and three largest cities west of the Mississippi.

4. What is meant by Land and by Water Hemisphere, and locate the center of each.

Ans.—Center of land hemisphere is in northern France, and of water hemisphere near New Zealand.

5. Name the divisions of Australia with their respective capitals.

6. What is the snow line? What is the height of this line at the Equator?

Ans.—The limit in elevation of perpetual snow, but this limit is variable and the line indeterminate.

7. Locate a Sargasso sea and tell how it is formed.

Ans.—One near the Azores, They are formed by action of ocean currents.

8. Which coast of the United States has the warmer climate, the Eastern or the Western? Why?

Ans.—Western on account of Japan Current.

9. Give the cause, course and benefit of the Gulf Stream.

Ans.—See full answer, p. 121, Vol. 4.

10. Name the highest elevation and lowest depression in the world, two bays in Ohio, and locate highest elevation in Ohio.

Ans.—Mt. Everest. Dead Sea. Sandusky and Maumee Bays. Logan Co.

1. Name the "Six Great Powers" of Europe.

Ans.—See last issue, p. 63, and add Turkey.

2. How large is the Desert of Sahara?

3. Where and what is Liberia?

Ans.—A Negro republic on the Grain Coast of West Africa, founded in 1822 by American philanthropists, among whom was Monroe, for freedmen.

4. Name N. Central States west of the Mississippi and the capitals.

5. Name the four classes of lakes, and give an example of each.

Ans.—(1) Lakes which neither receive nor emit streams; as, Ice Lake on Sawtooth Mt., Cal., and Lake Albano near Rome. (2) Emit, but do not receive streams; as, Tahoe on the summit of the Sierra Nevada, 1500 ft. deep, with pure water, Truckee River being the outlet. Lake Chautauqua is another example. (3) Receive, but do not emit streams; as, Gt. Salt Lake. (4) Both receive and emit streams; as, Lake Erie.

6. What are the physical advantages of the United States.

Ans.—Its excellent harbors, navigable rivers, great lakes, extent of fertile soil, vast deposits of coal, iron, copper and lead, and the richness of its gold and silver regions, and its favorable climate.

7. What are the natives of Madagascar called? Of Bornea? Of New Zealand?

Ans.—Hovas. Dyaks. Maoris.

8. Name the grand divisions in the order of their population.

9. What State is bounded by four straight lines?

10. Give the government of ten political divisions of Europe.

Ans.—For full exposition of all the European governments, see p. 94, Vol. 4.

GRAMMAR.

1. What is the difference between a personal and a relative pronoun?

Ans.—The difference exists in the use of the relative as a connective.

2. Decline *thou, it* and *man*.

Ans.—Thou, thy or thine—you, your, you; it, its, it—they, their, them; man, man's, man—men, men's, men.

3. What is the difference between an adverbial phrase and an adverbial clause?

Ans.—A clause contains the essential elements of a sentence, and a phrase does not.

4. Write a synopsis of the verb *stand* in the potential mode.

Ans.—I may stand, I might stand, I may have stood, I might have stood.

5. Correct, if necessary: Who do you study with? Their language, as well as their manners, were ridiculed. Each day and each hour bring their temptations. Neither Mary nor Jennie likes their books. No citizen and no ruler gave their influence.

Ans.—With whom do you study? Their language, as well as their manners, was ridiculed. Each day and each hour brings its temptations. Neither Mary nor Jennie likes her books. No citizen and no ruler gave his influence.

6. Write possessive, singular and plural, of lady, woman, man, mouse, child, it, hero.

Ans.—Lady's, ladies'; woman's, women's; man's, men's; mouse's, mice's; child's, children's; its, their; hero's, heroes'.

7. In what cases are compound personal pronouns used?

Ans.—Nominative and objective.

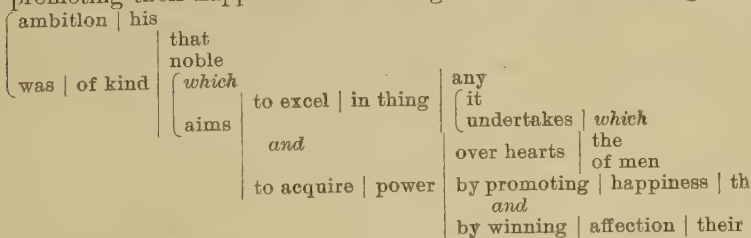
8. Write a sentence containing a complex element of the third class.

Ans.—The men who govern others by arbitrary power, lack the principles of true manhood.

9. Define an interrogative pronoun and parse all the words in your definition.

Ans.—It is a pronoun used for asking a question.

10. His ambition was of that noble kind, which aims to excel in whatever it undertakes, and to acquire a power over the hearts of men by promoting their happiness and winning their affections. Diagram.



1. Name the three ways of distinguishing the masculine and feminine genders.

Ans.—By different words; by suffixes; by prefixes.

2. Give the corresponding gender to the following: Earl, hart, executor, poet, Augustus, sorcerer, actor, and benefactor.

Ans.—Countess, roe, executrix or executer, poetess or poet, Augusta, sorceress, actress or actor, benefactress or benefactor.

3. Name three rules for the use of commas, four for periods, and five for capitals.

See text-book.

4. Give the different participles of come, lay, and sit.

ANS.—Coming, come, having come; laying, laid, having laid; sitting, sat, having sat.

5. What parts of speech are used as subordinate connectives. Give the office of each.

ANS.—Relative pronouns, conjunctive adverbs and conjunctions.

6. Write a sentence with a noun in apposition with a sentence, and one with a noun in the absolute case with a participle.

ANS.—*How his essays will read, a question of grave importance, was fully discussed.* The sun having risen, we commenced our journey.

7. Name the figures of grammar.

ANS.—Syncope, Ellipsis, Pleonasm, etc., etc. For a full list, see any good grammar. They are the figures of etymology and syntax. We presume figures of rhetoric should not be included.

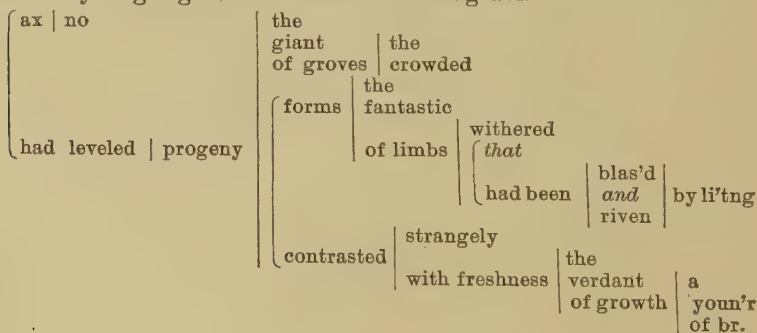
8. Correct if necessary: My brother caught the fish on a small hook baited with a Worm which you had for breakfast. I seen her to-day. You, him, and me study grammar. The lady whom you saw is my sister. Them boys are badder than ourn.

ANS.—My brother caught the fish which you had for breakfast, on a small hook baited with a worm. I saw her to-day. You, he, and I study grammar. The lady whom you saw is my sister. Those boys are worse than ours.

9. The child lay *sick* with a fever. The fruit is *ripe enough to eat*. She *seemed a creature fresh* from the hand of God. *Were* I rich I would purchase the property. Parse italicized words.

ANS.—*Sick* is an adjective, in the predicate with *lay*. *Ripe* is an adjective, in the predicate with *is*. *Enough* is an adverb, modifying *ripe*. *To eat* is an infinitive, with the construction of an adverb, limiting *enough*. *Seemed* is a copulative verb, agreeing with its subject *she*, in person and number, and takes the noun *creature* in the predicate. *Fresh* is an adjective, modifying *creature*. *Were* is a copulative verb, subjunctive mood, and agrees with its subject *I*.

10. No ax had leveled the giant progeny of the crowded groves, in which the fantastic forms of withered limbs, that had been blas'd and riven by lightning, contrasted strangely with freshness the verdant of growth a young'r of br.



ENGLISH GRAMMAR.

Answers to Queries.

1. Can a person be the antecedent of a pronoun? C. A.

Ans.—The grammatical antecedent of a pronoun must be a *word*. Often pronouns in the first or second persons have no antecedents.

2. Parse—Honor is *theirs* as *pioneers* of the west. Id.

Ans.—*Theirs* is a pronoun in the predicate with *is*. *As* is a conjunction; it connects *theirs* and *pioneers*. *Pioneers* is a noun, in apposition with *theirs*.

3. Her name is *Mary*. What gender is *Mary*?

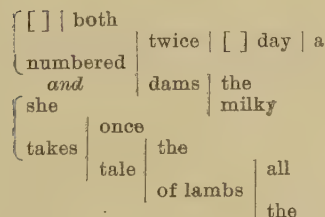
Ans.—It refers to *name*, not to the person, and we give it neuter gender.

4. Give construction of infinitives: He desires *to learn*: he ventured *to speak*; he likes *to play*; he dares *tread* the perilous way; he thought *to help* me; he determined *to pass*. Id.

Ans.—We are inclined to give all these infinitives the construction of adverbs, modifying the intransitive verbs. Consult Gould Brown, Webster and other standard authors.

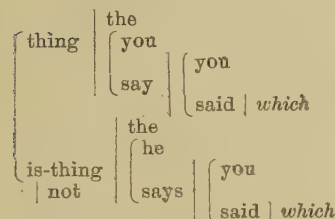
5. Diagram—Both numbered twice a day the milky dams,
And once she takes the tale of all the lambs.

TEACHER.



Dryden here uses *tale* in the sense of *number reckoned*.

6. Diagram—What you say you said is not what he says you said. Id.



7. Parse—The manager told him *when to come*.

Ans.—We prefer *to come* as the object of *told*, and *when* to modify *to come*. *Him* is the object of *to* understood.

8. Is *worth* a preposition in—He is worth a million. Id.

Ans.—It is so considered, by good authors.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

NOTE.—GEO. L. SHANER, *Stewarts Station, Pa.*, answered 869 and 873, J. H. W. SCHMIDT, *Ansonia, Ohio*, answered 868, 869, and 884. FOREST BALES, *North Lewisburg, Ohio*, answered 872.

943. Who were the "Six Nations" of Indians?

T.

ANS.—They were the most powerful confederation of Indians on the continent, known also as the Iroquois. They included only five tribes, known as the Mohawks, Oneidas, Onondagas, Senecas, and Cayugas. Afterwards the Tuscaroras joined the league, and the combination was called the "Six Nations." At that time the total number was estimated at 11,650, of which there were 2150 warriors. Their home was in the central and western part of New York. They are now scattered about on various reservations in New York, Wisconsin, Canada and Indian Ter. They fought on the side of the English in the Revolutionary War, and in the repeated battles their power was nearly destroyed.

EDITOR.

944. What does *Fitz* mean as used in compound names? *Id.*

ANS.—*Fitz* means a son. *Fitz-John* Porter, means son of John Porter; and *Fitz-William*, son of William Wentworth.

EDITOR.

945. Where does Allen G. Thurman live?

Id.

ANS.—In a fine new mansion on Rich Street, Columbus, next door to his son Allen W. Judge Thurman has been selected as the chief counsel in telephone suits about to be instituted at Washington.

EDITOR.

946. What and where is *Euxine*?

B. S. D.

ANS.—A name anciently applied to the Black Sea. It was so called after the establishment of Greek colonies on its borders, the term meaning hospitable sea.

EDITOR.

764. Describe the famous Dragon tree, the oldest tree now known.

ANS.—Some time since I read the life of Gautama, the founder of the Buddhist religion. The author of the work gives full credence to the native belief that the present famous tree connected with the life of Gautama is the identical tree under which it is believed that the famous Buddha sat. He says the tree bears evidence of being *very* old. The earth has gradually been raised about the trunk to preserve it. The records of the tree, he adds, have been preserved with the greatest care, and after a careful examination he pronounces them unquestionably reliable. This he says makes the tree by far the oldest to which we can refer with any authority.

The legends say, that Buddha went to sit under a banyan tree, or tree of Bodhi, when the god Indra brought him a seat. He resolved not to leave till the great transformation he was to undergo should be completed. King Mora felt the grounds and foundations of his palace shaking, went to Gautama and shot arrows at him, which as they fell became lotus flowers. He was subjected to many temptations; demons came to him; the air was filled with grim faces, gnashing teeth, and bristling spears, when a spirit in the air was heard to say, The Bodhisattwa attains this day perfection under the Bodhi tree, cease your hostility and wait on him with respect. The tree under which Buddha sat has been held sacred by his followers. The account given in the work to which I refer is very interesting. What I have given above has been from memory.

H. A. WOOD.

811. Where in the U. S. are the richest deposits of salt?

ANS.—In Onondago Co., in the vicinity of Syracuse, are extensive salt works (said to be the most important in the U. S.) These works are situated near the

head of Onondago lake; tho' the pumps are in the lake, the "brine" is not lake water, it is drawn up *through* the lake and conducted by means of pipes to the various blocks or boiling places. This important industry is carried on in the valley of the Seneca river.

A. M. SCRIPTURE.

NOTE.—Please correct latter part of answer to this query, p. 23, Jan. No.

804. Name the man who rang the Liberty Bell, July 4, 1776.

ANS.—After diligent search I received the following from the Superintendent of the National Museum of Independence Hall, Philadelphia: "William Hurry, who emigrated from Scotland to America, and settled in the city of Philadelphia. He was keeper of the State House and door-keeper while Congress was in session. He tolled the old bell, which can still be seen in Independence Hall, when the Declaration of Independence was signed." GEO. L. SHANER.

823. During whose reign in France was the decree issued that the King's effigy should be stamped on all Moneys? *Id.*

ANS.—Henry II. See any good History of France.

N. B. WEBSTER.

867. Explain how the vibration of the pendulum proves the earth to be an oblate spheroid.

AARON MOUL.

ANS.—The analytical theory of the figure of the earth requires, on the hypothesis of an oblate spheroid, that the force of the earth's attraction in varying latitudes, allowance being made for rotation, is such that a pendulum of fixed length should have determined rates. The object of pendulum experiments is the verification of the results of theory.

WM. HOOVER.

868. What is meant by *The cackling of Geese saved Rome*?

In 390 B. C. 70,000 Gauls marched against Rome. The Romans on hearing of their approach hurried out of the city, and on the 16th of July met the Gauls on the Allia, a small river, 11 miles above Rome. The Gauls being led by Brennus who attacked the Romans on the flank, threw them into confusion. Some escaped across the Tiber to Veii, a few reached Rome, and the rest were slain. The Romans agreed that those in the vigor of age should withdraw to the Capitol. The Gauls entered the city, burned all the buildings except a few houses on the Palatine. The Capital was the next object of attack, there was only one steep way leading up to it, and all assaults by the besiegers were easily repulsed. The Gauls thereupon turned the siege into a blockade which lasted 7 months. Meanwhile the scattered Romans took courage, met at Veii, resolved to recall Camillus from exile, and appoint him Dictator. In order to obtain consent of the senate, Pontius Cominius offered to swim across the Tiber and climb the Capitol. Reaching the top unnoticed by the enemy, he obtained approval of the senate and returned in safety to Veii. The next day some Gauls observed the traces of his steps, and in the dead of night, climbed up the same way. The foremost of them had already reached the top unnoticed by the sentinels and dogs, when the cries of some geese, sacred to Juno, roused M. Maullius from sleep. M. Maullius thrust down the Gauls who had clambered up, and gave the alarm. The Gauls remained before the capital until the Romans at length agreed to pay them 1000 pounds of gold, on conditions of their quitting the city and territory. B. F. FINKEL, N. Lewisburg, O.

869. Why was Scott's army called "Army of Occupation"? *Id.*

ANS.—Scott's Army was not called the "Army of Occupation." There were three plans of operation in the Mexican, as follows: The *first* was for Gen. Taylor to take and hold the disputed territory; thus *his* army was called the *Army of Occupation*; because he was to hold or occupy the country. *Second*, Gen. Kearney to cross the Rocky Mts. and conquer New Mexico and California; thus it was called the *Army of Acquisition*. *Third*, the Commander-in-chief, Gen. Scott, to take the city of Mexico; thus it was called the *Army of Invasion*.

J. W. KECKLER.

870. Who originated the idea of the Postal Card?

S.

ANS.—A German treatise on the history of the postal card states, that Dr. Stephen, a German State official, originated this boon to correspondents. He wrote an essay upon it in 1865. Austria was the first to adopt it, early in October 1869, and Germany followed in 1870.

EDITOR.

871. Where is the "Valley of Death"?

Id.

ANS.—The "Death Valley" is in California.

J. W. KECKLER.

Death Valley proper is in California, though the great detrital sink, part of which, like the valley of the Jordan and Dead Sea, is below the ocean level, extends into Nevada and includes a large part of the basin or basins between the Wasatch mountains on the east and the Sierra Nevada on the west. There are really several low valleys between ridges of Cordilleras more or less distinct. The greatest depression of the California "Death Valley" proper is 300 feet below the sea level. The surface of the Dead Sea is 1000 feet lower. The Death Valley is about 70 miles long, and from 5 to 15 miles wide. It is hemmed in by high mountains of volcanic and sedimentary origin. Full accounts of this great sink-hole may be found in Reports of the Wheeler Explorations west of the hundredth meridian.

N. B. WEBSTER.

In the Island of Java. It is simply the crater of an extinct volcano, half a mile in circumference, filled with carbonic-acid gas, which continually emanates from fissures in the bottom of the valley. The gas being invisible, and entirely irrespirable, every living thing that descends below the margin of it is instantly suffocated; and, as the same fate awaits any one that may go to the rescue, the ground is covered with the bones of numerous animals, and even men, that have approached the precincts. A desert valley in Southern California bears the same name. This depression, which is situated east of the highest ranges of the Sierra Nevada (the Telescopes), is watered by the Amargoza River. It is about forty miles wide, a hundred miles in length, and its center is, in winter, a salt marsh, whose surface is two hundred and eighty feet below the sea level.

J. H. W. SCHMIDT.

872. What does "Pouring oil on troubled waters" mean?

Id.

ANS.—It is well authenticated fact that pouring oil upon them will still the troubled waves of the ocean; so "Pouring oil upon the troubled waters" means the stilling of turbulent human passions by a word or deed.

J. H. W. SCHMIDT.

873. Give incident in English history upon which was founded, *Curfew must not ring to-night*.

Id.

ANS.—*Curfew must not ring to-night*, was written by Rosa Hartwick, now Mrs. Ed. C. Thorpe, April 1867. It is founded on an incident in English History. Basil Underwood was a young soldier in the time of the Protectorate, and his only crime seems to have been unswerving loyalty to the King. The maiden pleaded in vain for a reprieve from the judges. They would not delay the execution even until Cromwell should arrive. After her fruitless efforts with the judges, she turns to the old sexton, and at this point the poem takes up the story.

GALEN.

874. What is placed in the floor to commemorate the spot where Garfield fell when shot?

J. W. CLARK.

ANS.—The spot on the floor where Garfield was standing when shot is marked with a star made of metal.

C. R. GEORGE, *Gettysburg, O.*

875. What is meant by the "Truce of God" as mentioned in French history?

H. A. WOOD.

ANS.—It consisted in the suspension for a stated time, and at stated seasons and festivals, of that right of private feud for the redress of wrongs, which, under certain conditions, was recognized by mediæval law or usage.

J. H. W. SCHMIDT.

877. What is the origin of the title *Prince of Wales*? *Id.*

Ans.—Caernarvon is the chief city in North Wales; its situation is handsome, and its streets are wide, regular, and convenient, it is celebrated for the splendid Castle built by Edward I. 1282. Here Edward II. or Edward of Caernarvon, was born, and immediately created the first English Prince of Wales.

GEO. L. SHANER.

It is traditionally related that Edward I. engaged to give the Welsh people a prince who would be born among them, and not know a word of English, and fulfilled the promise by bestowing the principality on his infant son Edward, born at Caernarvon Castle. Edward, by the death of his elder brother, became heir-apparent. Edward III., his son, was never Prince of Wales; but in 1343, he invested his son Edward, the Black Prince, with the principality, and from that time the title of Prince of Wales has been borne by the eldest son of the reigning king.

J. H. W. SCHMIDT.

878. Why are four I's (IIII.) instead of IV. on dials of clocks and watches? *A. L. FOOTE.*

Ans.—Because IV. was originally represented by IIII. Even after the subtractive collocation was introduced by the Romans the two forms were alternative, and the latter was used on the dial-plates of early clocks. *EDITOR.*

879. Who said—"Laugh where we must, be candid where we can"? *Id.*

Ans.—This line is from Pope's *Essay on Man*, Ep. 1, Line 15.

Laugh where we must, be candid where we can,
But vindicate the ways of God to man.

That is, to put man in right relations with the laws of life, health and happiness. *J. H. W. SCHMIDT.*

880. Give author and reference of following. *W. A. MARSH.*

Sweet bird, thy bower is ever green,
Thy sky is ever clear;
Thou hast no sorrow in thy song,
No winter in thy year.

Ans.—The lines form a stanza of an ode entitled "To the Cuckoo", by John Logan, a Scotch poet of the last century. *WM. HOOVER.*

881. What State Legislatures passed "Personal Liberty Laws"? *W. F. L. SANDERS.*

Ans.—*Histories* do not say. Barnes says several of the Northern States passed "Personal Liberty Bills." *J. W. KECKLER.*

882. How many votes had the owner of a hundred slaves, 60 or 61?

Ans.—He had 6 votes to every 10 slaves he held that would give him 60 votes for his slaves while he himself would have one. So he surely had 61 votes. *J. W. KECKLER.*

883. What part of the Alien Law of 1798 is still the law of the land? *Id.*

Ans.—That part of the Alien Law of 1798 is still the Law, which relates to the time foreigners are to be in this country before they can become citizens. The old law of 1798 required them to be in this country 21 years. The present law five years. *GEO. L. SHANER.*

The act of 1798 authorizes the removal of the aliens of a country with which we may be at war; and, on the commencement of a war, the alien of the enemy loses his status in courts, and his property can be confiscated; but these statutes have never been enforced. *J. H. W. SCHMIDT.*

884. What was the Clayton-Bulwer Treaty?

Id.

ANS.—This treaty was a convention between the United States and Great Britain, negotiated at Washington in 1850 by John M. Clayton, Sec'y of State, and Sir Henry Lytton Bulwer, British envoy. It consists of nine articles, the preamble to which states its object to be the desire of "consolidating the relations of amity" between the two nations "by setting forth and fixing in a convention their views and intentions with reference to any means of communication by ship-canal which may be constructed between the Atlantic and Pacific oceans by way of the river San Juan de Nicaragua, and either or both lakes of Nicaragua or Managua, to any port on the Pacific Ocean. . . ." The negotiators signed the treaty April 19, and the ratifications of the two countries were exchanged at Washington July 4. Owing to misunderstandings as to rights of either country gave occasion to elaborate debates in the U. S. Senate in 1853-54-55, and later. Especially in 1881-82 on account of the proposed construction of the ship-canal of De Lessops. Mr. Blaine and his successor, Mr. Freylinghuysen, as Secretaries of State, and Lord Granville, the British minister of foreign affairs, had quite a correspondence on this subject.

EDITOR.

885. What was Jefferson's Proviso in regard to slavery? When was it voted on?

Id.

ANS.—The law of British rule in Virginia "forbade the manumission of a slave, except upon the condition that he was immediately sent out of the state." Jefferson, in the five days session of the House of Burgesses in the spring of 1769, asked the repeal of this law, but failed.

WILLIAM HOOVER.

886. What was the Fitz-John-Porter Bill?

Id.

ANS.—The Bill was to restore him to the rank of Colonel, and with the pay of the same from the time he was relieved of his command. G. L. SHANER.

At the second battle of Bull Run, Aug. 29 and 30, 1862, Fitz-John Porter lay back with his division within sight and sound of the battle, refusing to obey repeated orders to advance. The defeated general, John Pope censured him for this delinquency, whereupon he was tried by a court-martial, cashiered in January, and dismissed from the service. He was thus disqualified to hold any office of trust in the U. S. Government. He appealed to President Grant in 1870 for a reversal of this decision, stating distinctly his reasons. We believe Grant favored his re-instatement and a bill was introduced in Congress by which he would not only be re-instated, but receive back pay from the time he was suspended. That bill has been brought up again and again for fifteen years, passed the House a short time ago, and at this writing it is before the Senate.

EDITOR.

887. When was the fine ship *Atlantic* lost? Give some particulars of the affair.

Id.

ANS.—The *Atlantic* was the pioneer steamship of the Collins Line. She sailed from New York April 27, 1849, and arrived in the Mersey May 10. In April 1850, she was one of four vessels of this line to carry the U. S. mail, between New York and Liverpool, but being too large for any of the docks at Liverpool, she had to lay out in the river. She was said to be the largest and finest steamer that had been built at that time. Her length between the perpendiculars was 276 ft.; beam, 45 ft.; across the paddles, 75 ft.; depth of hold $31\frac{7}{8}$ ft.; diameter of wheel 36 ft.; tons burden, 2,860; cost \$750,000. After being used for a coal repository and other purposes, she was broken up in New York in 1879. The Collins enterprise, aided liberally by Congress utterly failed. Mr. Olds, of Ohio, in the House of Representatives, while advocating the Collins subsidy, said, "We have the fastest horses, the prettiest women, and the best shooting guns in the world. The Collins Line must beat the British steamers. Mr. Collins has not disappointed us." This line had the fastest steamers on the Atlantic at that time.

EDITOR.

888. Give the best definition of education you can. JAS. SMITH.

ANS.—The harmonious and equable evolution of the human powers, is what the Prussians give. James Stewart Mill says that it includes whatever we do for ourselves, and whatever others do for us, for the purpose of bringing us nearer to the perfection of our nature. EDITOR.

889. How would you keep the primary pupils busy? *Id.*

ANS.—By giving them exercises to write on slates; letters, figures, lines, words, sentences of their own construction, elements of penmanship, simple polygons, outlines of room and school premises, windows, streets, etc. Give them coins of various denomination and teach them how to make change, and to pay certain amounts. Have a 12-inch rule, pint measure, small scales and weights, clock, marbles for counting, and have them to write out all their lessons. EDITOR.

890. What is the so-called "New Education"? *Id.*

ANS.—We have received no answer to this query, and it is doubtful whether it can be clearly answered, for the *New Education* is simply improved methods of teaching which have gradually brought our schools out of the monstrous practices of putting the instruction on the outside and driving them in with the rod—of cramming the mind with definitions, etc., not understood. We committed Smith's Grammar in our school days, and could run through parsing like this: John is a noun, because it is a name; proper, because it is a particular name; and so on, not knowing anything of the elements and construction of the English sentence. In Arithmetic we "ciphered" through the book, being satisfied when the answer was obtained, logically or otherwise. There are some sins connected with the "new education," however, which must be abandoned; such as paving the road to knowledge that the pupil has no obstacles to surmount, and the teacher doing most of the *thinking*. There is no royal road to learning, and the principles upon which a true education must be based are as old as truth itself. An education that will enable a pupil to *do his own thinking*, and that will make him careful about his moral and social obligations, is the education, whether old or new. EDITOR.

891. What is now the *Presidential Succession*? Explain fully. *

ANS.—What is known as the Presidential Succession Bill, is a measure devised originally by Senator Hoar, of Massachusetts, and introduced by him in the Senate at the last session of Congress. After some debate and a few unimportant verbal changes or amendments it was then passed by that body, but failed of action in the House. The death of Vice-President Hendricks during the interim left Congress in a frame of mind to guard against the accidents of sudden fate in the matter of Presidential succession, and Mr. Hoar was early in the field with his old measure when Congress assembled in December. After a short debate and the rejection of several proposed amendments it again passed the Senate on Dec. 18, 1885, and went at once to the House. After careful consideration in the Judiciary Committee of that body it was reported favorably to the House in precisely the shape it had passed the Senate. As in the Senate, all attempts at amendment were defeated in the House, and after a two days debate it was overwhelmingly passed. The Bill provides that when there is a vacancy in the offices of both President and Vice-President, the Cabinet officers shall succeed to the Presidency in the following order: Sec'y of State, Sec'y of the Treasury; Sec'y of War, Attorney-General, Postmaster-General, Secretary of the Navy, and Secretary of the Interior. The Cabinet officer thus acting as President is to hold office until the disability of the President or Vice-President is removed, or until a new President is elected to succeed him at the end of the term of the President or Vice-President whom he succeeds. The Bill also authorizes the acting President to call an extra session of Congress with twenty days from the time he assumes the duties of the office, should the regular meeting of Congress not occur within that time.

J. H. W. SCHMIDT.

QUERIES.

920. Name the great men who have died within a year, and give their callings. J. H. SPENCER, *Hollansburg, O.*

921. What is the Lover's Leap? Give history. *Id.*

922. Why was Alaska so named? Who introduced into Congress its purchase? *Id.*

923. What King entered the camp of his enemies as a spy? *Id.*

924. What was the "Gun-powder Plot?" *Id.*

925. Describe the first battle fought on American soil. *Id.*

926. Who wrote the "Song of Twickenham Ferry"? WILLIAM HOOVER, *Athens Ohio.*

927. In what battle did the English first employ artillery? GEO. L. SHANER, *Stewarts Station, Pa.*

928. What were Arnold's last intelligent words? *Id.*

929. When and by what colony was it enacted that wheat should be received in payment of all debts? H. A. WOOD, *Cleveland, O.*

930. When was the first temperance society in this country organized? *Id.*

931. Describe in full the northern boundary of the U. S., giving the principal posts with inscriptions. J. Q. HELMAN, *Bradford, O.*

932. Give names of the men who met in convention to adopt the constitution of Ohio. DARKE.

933. When did Sherman burn Atlanta? WARREN LOY, *Pyrmont, O.*

934. What Vice-President was married to a mulatto? D. M. BRUMGARD, *Lock Haven, Pa.*

935. On what occasion did a naval officer say, "Blood is thicker than water"? J. M. GREENWOOD, *Kansas City, Mo.*

936. Why does a little grease thrown into a kettle of hot foaming syrup reduce the foam? LAWRENCE DUNLAP, *Zanesfield, O.*

937. Why is the title *Sir* given to Newton, Scott, Raleigh, *et al.*? *Id.*

938. When were the capitals last changed of W. Va., La., and Dak.? *Id.*

939. What and where were the "Seven Cities of Cibola"? *Id.*

ANS.—See *Visitor*, Vol. 4, p. 149. Also, *Eclectic History*, p. 28. EDITOR.

940. Explain the meaning of the phrase, *Comin' thro' the rye*, as used by Burns? A. A.

941. Why is the climate of Michigan so much milder than that of Iowa? C. W. BIGLER, *Gettysburg, O.*

942. What is the origin and of *boycott* as used at present? C. A.

Answers should be received on or before May 10.



EDITED BY

JOHN S. ROYER.

VOL. VII.

MAY, 1886.

No. 5.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

867. By W. C. BINKLEY, *Cincinnati, Ohio*.—"A gentleman proposes to plant a vineyard of 10 acres. If he places the vines 6 feet apart, how many more can be plant by setting them in the quincunx order than in the square order, allowing the plat to lie in the form of a square, and no vine to be set nearer its edge than 1 foot in either case?"

By A. L. FOOTE, *Merrick, N. Y.*

The side of the field is $40 \times 16\frac{1}{2} = 660$ feet. If we plant in the square order, we shall have $(658 \div 6) + 1 = 110$ plants in a row, and $110^2 = 12100$ vines.

In the quincunx order, let the first row at top of field commence 4 feet from fence on left, and we have $(655 \div 6) + 1 = 110$ vines in this row, and let the second row begin at left of field in like manner 1 foot from the fence, and it will have 110 vines. Now the distance between the rows is $\sqrt{6^2 - 3^2} = 3\sqrt{3}$ feet, and $(658 \div 3\sqrt{3}) + 1 = 127$ rows. Hence $127 \times 110 = 13970$ vines, or $13970 - 12100 = 1870$ vines more by the quincunx.

868. By L. A. REED, *Cleveland, Ohio*.—Find the volume generated by the revolution of a circle on a tangent.

By A. M. SCRIPTURE, *Clinton, N. Y.*

The center of gravity of the surface being at the center of the circle, r = radius of circle and also the distance of center of gravity from axis of rotation; hence the circumference described by the center of gravity is $2\pi r$. Area of circle is πr^2 , and the volume generated is $2\pi r \times \pi r^2 = 2\pi^2 r^3$.

APPLICATION.—Suppose a circular fan 20 inches in diameter should be made to revolve around a thin wire, through how many cubic inches of air would it pass in each revolution? *Ans.*, $2\pi^2r^3 = 2 \times 9.869604401089 \times 1000 = 9869.6+$.

869. *By N. B. WEBSTER, Yonkers, N. Y.*—A tract of land of triangular form is bounded on one side, for the distance of two miles, by a straight road. The measurement of the other sides is impossible on account of impassible swamps. The corners and bearings of the tract being known, I cut off a portion of it from the vertex opposite the road, by a line 15 chains long having the direction of the road, and find the other sides of the part cut off to be respectively 13 and 14 chains. How many acres in the whole tract?

By W. C. BINKLEY, Cincinnati, Ohio.

Since the triangle cut off has the same angles and directions as the larger, their homologous lines are in proportion. The altitude of small triangle is thus obtained: $15 : 13 + 14 :: 14 - 13 : (1.8)$; $(15 - 1.8) \div 2 = 6.6$ chains is the distance from the foot of the perpendicular to the nearest end of base, and $\sqrt{(13^2 - 6.6^2)} = 11.2$ chains is the altitude. In 2 miles are 160 chains, and we have $15 : 11.1 :: 160 : 119.4\frac{2}{3}$ chains = alt. of larger triangle, and its area is $119.4\frac{2}{3} \times 160 \div 2 = 9557\frac{1}{3}$ sq. ch. or $9557\frac{1}{3} \div 10 = 955.7\frac{1}{3}$ acres.

By R. A. LEISY, Burton City, Ohio.

Area of of part cut off is $\sqrt{[21(21-15)(21-14)(21-13)]} = 84$ sq. ch., and being similar to the whole triangle, we have by similar figures, $15^2 : 160^2 :: 84 : (9557\frac{1}{3} \text{ sq. ch.})$, and the area is $9557\frac{1}{3} \div 10 = 955.7\frac{1}{3}$ acres.

870. *By A. G. GUNDEB, Spartansburg, Ind.*—Two boys run in opposite directions round a rectangular field whose area is 1 acre. They start from one corner and meet 13 yds. from the opposite corner; and the rate of one is $\frac{5}{6}$ the rate of the other. Determine the dimensions of the field.

By A. L. FOOTE, Merrick, N. Y.

Algebraically.—Let x = yards in width of field and the length is $4840 \div x$. Now, since A's rate is to B's as 5 to 6, A runs $x + 4848 \div x - 13$ and B runs $x + 4840 \div x + 13$ yards. By the conditions we have $x + 4840 \div x - 13 : x + 4840 \div x + 13 :: 5 : 6$, whence $x^2 - 143x = -4840$, and $x = 55$ yd.; the length is 88 yd.

Arithmetically.—Since their rates are as 5 to 6 and the final difference in distances run 26 yd., we have the sum of one side and one end of the rectangle $13 \times 11 = 143$ yd., and half the difference of the same is $\sqrt{[(1\frac{1}{2} \times 5)^2 - 4840]} = 3\frac{3}{2}$ yd.; $\therefore 14\frac{3}{2} + 3\frac{3}{2} = 88$ yd., the length, and $14\frac{3}{2} - 3\frac{3}{2} = 55$ yd. width.

By S. J. BROWN, *Blanchester, Ohio.*

Since the first walks 13 yd. beyond the opposite corner from the starting corner, he walks 26 yd. farther than the second, and this is $\frac{1}{6}$ of the distance walked by first, and $\frac{1}{3}$ of that walked by the second; hence one walks $6 \times 26 = 156$ yd., and the other $5 \times 26 = 130$ yd., and the sum of the length and width is $(156 + 130) \div 2 = 143$ yd. or 26 rds. Suppose now that we have four such rectangles, and placing the end of one against the side of another, it will form square each side of which is 26 rods, and area $26^2 = 676$ sq. rd. Area of the four rectangles would be $160 \times 4 = 640$ sq. rd., and side of the square enclosed by the four rectangles placed as designated above, is found to be $\sqrt{(676 - 640)} = 6$ rods which must be the difference between the length and the width of rectangle. $\therefore$ the width is $(26 - 6) \div 2 = 10$ rods and the length $(26 + 6) \div 2 = 16$ rods.

871. By W. C. MENDENHALL, *West Manchester, O.*—What is the solidity of the middle frustrum of an oblate spheroid, the middle diameter being 45, that of either end 30, and the length 15?

By T. L. BREWER, *Mt. Heron, Ohio.*

RULE.—To twice the square of the middle diameter add the square of the diameter of either end, and this sum multiplied by the length and by .2618, will give the solidity. Hence

$$[(45^2 \times 2) + 30^2] \times 15 \times .2618 = 19438.65 \text{ cu. in.}$$

872. By E. P. CLEMENS, *Spartanburg, Ind.*—What is the length of a pendulum that shall vibrate just 3 times a second?

By D. W. K. MARTIN, *Versailles, Ohio.*

Since the length of a pendulum vibrating seconds in this latitude is about 39.1 inches, and the lengths of pendulums are inversely proportional to the squares of their numbers of vibrations in a given time, we have $3^2 : 1^2 :: 39.1 : (4.34 \text{ in.})$, length required.

873. By D. W. K. MARTIN, *Versailles, Ohio.*—Given two sides of a triangle to be 12 and 8 respectively, and the included angle $\frac{1}{2}$ of the angle opposite the greater side; to find the remaining side.

By WM. WILEY, *Detroit, Mich.*

Let x = the included angle; then $2x$ is the angle opposite 12, and the other angle (opposite 8) is $180 - 3x$, whose sine is $\sin 3x$. Hence $\sin 2x : 3 :: \sin 3x : 2$, or $3 \sin 3x = 2 \sin 2x$. But the sine of $3x$ is $4 \sin x \cos^2 x - \sin x$, and sine of $2x$ is $2 \sin x \cos x$. $\therefore 12 \sin x \cos^2 x - 3 \sin x = 4 \sin x \cos x$. Dividing by $\sin x$, $12 \cos^2 x - 3 = 4 \cos x$, whence $\cos x =$

$\frac{1}{6}(1+\sqrt{10})=.693713=\cos 46^{\circ}4'31''$. By the proportion
 $\sin 2x : 12 :: \sin x : 3d \text{ side}$, we find the required side to be 8.6491.

874. By J. B. SANDERS, *Cambridge City, Ind.*—Taking any scalene triangle, construct another equivalent to it, but *equilateral*.

By WM. WILEY, *Detroit, Mich.*

Let the area of the scalene triangle be α , and let x be the side of the required equilateral triangle. Then $x^2 \sin 60^{\circ} = 2\alpha$, and $x^2 = 2\alpha \div \sqrt{\frac{3}{4}}$, whence $x = (2\alpha \div \sqrt{\frac{3}{4}})^{\frac{1}{2}} = \sqrt{(4\alpha \div \sqrt{3})}$.

Application.—Suppose the sides of the scalene triangle to be 13, 14, 15, then $\alpha = 84$, and $x = \sqrt{(4\alpha \div \sqrt{3})} = \sqrt{(336 \div \sqrt{3})} = 13.928$, or by *Rule*—Divide 4 times the area by 1.732 and extract the square root, will give side of equilateral triangle.

875. By N. R. OLIVER, M. D. *Dorchester, Ontario, Can.*—Required the area of a square, its side is equal to the sum of the two digits which express its perimeter, and if 6 be added to its area, the sum will be equal to the perimeter inverted?

By D. H. DAVISON, *Minonk, Ill.*

Let $x^2 = \text{area}$; then $4x = \text{perimeter}$. Let $y = \text{unit digit}$, and $z = \text{ten's digit of perimeter}$; then $x = y + z$, $4x = 10z + y$, $x^2 + 6 = 10y + z$. Eliminate y and z from these three equations, and we have $x^2 - 7x = 6$, from which $x = 6$ or 1; $\therefore \text{area} = 36$ or 1. The former value only fills the conditions, but if we take the latter value and add 6 to its perimeter, the sum will give the digits of its area transposed.

876. By J. C. ROEBUCK, *Rock Falls, Iowa.*—A 2-inch hole is bored in a wet board 5 inches square. What will be the size of the hole when it has dried 5%?

By J. W. PFEIFFER, *Bolivar, Ohio.*

In drying, boards do not shrink in length but in width. The hole is $\frac{2}{5}$ of the length of the board, and in drying 5%, the hole diminishes $\frac{1}{10}$ of $\frac{2}{5}$ in the direction of the width of the board, or $\frac{1}{50}$; hence the hole is an ellipse of which the major axis is 2 in. and the minor axis is 1.96 in.

877. By R. J. TOTTEN, *New Wilmington, Pa.*—What must be the shape of a vertical pillar that it may appear of the same breadth all the way up to a spectator in a given position?

By WM. WILEY, *Detroit, Mich.*

The shape must be two frustums of pyramids, whose smaller bases are equal, and coincide with each other. The frustum below the level of the eye is upright and that above the eye, inverted.

878. By D. H. DAVISON, *Minonk, Ill.*—A and B husk a field of corn for \$20. When they husk five rows at a time, A husks three standing rows, while B husks the down row and one standing row; when they husk six rows at a time, B husks three standing rows, while A husks the down row and the other two standing rows. How must they share the money? Two-elevenths of the rows in the field were down rows, what was it worth to husk them; and what to husk the standing rows?

By C. W. THOMPSON, *Kansas City, Mo.*

Let s = value of each standing row and d , each down row. Then

$$3s : s+d :: 2s+d : 3s; \text{ and } 2d+9s=20,$$

whence $d = \frac{1}{2}(20-9s)$. Substituting this value in the proportion, we find $s = \$1.655+$, and $9s = \$14.90$, cost of husking the standing rows, and $2d = 20 - 9s = \$5.10$, cost of husking the down rows. During each "round trip," A husks 1 down row and 5 standing rows, and should receive $\$2.55 + \$8.28 = \$10.83$, while B husks 1 down row and 4 standing rows, and receives $\$2.55 + \$6.62 = \$9.17$.

By GEO. C. RUSSELL, *Petaluma, Cal.*

Let x = units of work required to husk a standing row, and y = that for down row. When they husk 5 rows, A does $3x$ and B $x+y$, but when they husk 6 rows, A does $2x+y$ and B $3x$. Hence

$$3x : x+y :: 2x+y : 3x.$$

Let $x = my$, and our proportion becomes

$$3my : my+y :: 2my+y : 3my,$$

and dividing by y , and forming an equation we have

$$9m^2 = 2m^2 + 3m + 1,$$

whence $m = .648$. If $y = 1$, $x = .648$, $3x = 1.944$, and $x+y = 1.648$. Now \$20 must be divided in the proportion of 1.944 and 1.648, which gives A the first part or \$10.83, and B the second, or \$9.17

There are 2 down rows, or 2 parts, and 9 standing rows, or $9 \times .648 = 5.832$ parts of the whole cost, giving \$5.10 for cost of husking down rows and \$14.90 cost of standing rows.

879. By MARTIN RICE, *Lone Jack, Mo.*—When Bascom kept grocery at the corners he bought a barrel (44 gallons) of whisky, 50 per cent pure alcohol. He drew out a jug full, as he said, for medical purposes, and then filled up the barrel with water. He next drew out another, same size, for the especial use of himself and Nasby, and filled up with water again; and then continued to draw out jug full after jug full for his customers filling up each time, till he had drawn out 42 times, when a meddling inspector came along and upon examination he found that the liquid in the barrel contained only 2% alcohol. The question now is, how large was that jug, and what were his profits, if he bought at \$1.50 a gallon and sold for 40 cents a pint.

By WM. WILEY, *Detroit, Mich.*

Let the contents of the jug equal the one- x th part of the barrel.

Then after the first drawing there will remain 1 less one- x th part, or $(x-1) \div x$; after the second draw there remained

$$\left(\frac{x-1}{x}\right)\text{th part of } \left(\frac{x-1}{x}\right)\text{th, or } \left(\frac{x-1}{x}\right)^2$$

and so on, till after the 42d draw there remained

$$\left(\frac{x-1}{x}\right)^{42}; \text{ and } \frac{2}{50} \text{ or } \frac{1}{25} \text{ of the alcohol remained, } \left(\frac{x-1}{x}\right)^{42} = \frac{1}{25}.$$

If we now put r for the 42d root of 25, we have

$$\frac{x-1}{x} = \frac{1}{r}, \text{ whence } x = \frac{r}{r-1} \text{ and } \frac{1}{x} = \frac{r-1}{r}.$$

The value of r is 1.0796526, making the contents of the jug to be $44 \times [(r-1) \div r] = 3.24615$ gallons or 25.9692 pints. The amount received is $42 \times 25.9692 \times .40 = \436.28 . The cost is $44 \times \$1.50 = \66 , and the profits are \$370.28, which is supposed to be the assessment on Bascom by the committee for campaign expenses.

List of Contributors to this Number.

- B. F. FINKEL, *North Lewisburg, Ohio*, 867-8.
 T. L. BREWER, *Mt. Heron, Ohio*, 871-2
 S. J. BROWN, *Blanchester, Ohio*, 867-8-9-70-1-2-8-9
 D. W. K. MARTIN, *Versailles, Ohio*, 867-9-70-2-5.
 C. W. THOMPSON, *Kansas City, Mo.*, 867-8-70-4-5-8.
 MARTIN RICE, *Lone Jack, Mo.*, answers to all.
 R. A. LEISY, *Burton City, Ohio*, 867-9-70-5.
 D. H. DAVISON, *Minonk, Ill.*, 867-9-70-2-5-8-9.
 W. C. BINKLEY, *Cincinnati, Ohio*, 867-8-9-70-1-2-5-8-9.
 WM. WILEY, *Detroit, Mich.*, 867-8-9-70-2-3-4-5-6-9.
 A. L. FOOTE, *Merrick, N. Y.*, 867-8-9-70-1-2-3-4-5-6-8-9.
 J. K. ELLWOOD, *Mauch Chunk, Pa.*, 868-73-5.
 A. M. SCRIPTURE, *Clinton, N. Y.*, 867-60-1-4-8-9-70-2-5.
 J. E. GENSEMER, *Marshallville, Ohio*, 869-70-5.
 J. W. PFEIFFER, *Bolivar, Ohio*, 869-70-3-4-5.
 GEO. C. RUSSELL, *Petaluma, Cal.*, 870-2-3-5-8.
 D. S. POND, *Rochester, Ohio*, 869.
 S. G. CAGWIN, *New London, N. Y.*, 869-70-71-72-73-74-75.

The editor's remark, p. 53, was based on the supposition that the time was required for the first meeting as the original problem implied. The solutions are, therefore, wrong in the result only. Answer should be $2 \times 3\frac{1}{2} = 6:30$, P.M.

Owing to tardiness in receiving information, we are unable to publish the biographical sketches of contributors this month. We hope to present them in June. They will be interesting. The *Visitor* family should get acquainted.

The solution of Prob. 820, p. 5, by Mr. Foote, contains an oversight in some of the combinations. The correct answer is 5,225,472,000. The method of solution is all right. We thank contributors for pointing out all mistakes.

Marcus Baker, lately of the U. S. Coast Survey but now of the U. S. Geological Survey, has our thanks for a copy of his elegant and instructive paper on *A Group of Circles Related to Feuerbach's Circle*, read before the Philosophical Society of Washington, and for his continued support of the *Visitor*. He has a full set from the beginning. He is an eminent mathematician and managed several popular Coast surveys. We wish him increasing honor, pleasure and profit in his new field of labor.

Problems for Solution.

892. The cost of papering the walls of a room 26 feet long and 19 feet wide with paper 2 feet wide at 7 cents a yard, is \$12.60; how high are the walls?

By REQUEST.

893. The face value of two notes is \$1020, both due in 2 years. One is discounted at 5% bank discount and one 5% true discount, and the entire proceeds is \$923. Find the face of each.

Id.

894. A certain quantity of air has a volume of 195.5 cu. ft. at 27.8°. What will be its volume at 100°? By proportion.

Id.

895. Three persons, A, B and C are respectively 30, 40 and 50 years of age, and are to receive a sum of money at the end of 10 years, provided they live that time, in which case it is to be shared equally; but if A dies, B and C are each to have $\frac{1}{2}$ of A's in addition to their own. If B dies A and C are to have each $\frac{1}{2}$ of his in addition to their respective share, and in like manner, if C dies A and B are to have $\frac{1}{2}$ of his. If any two of them die the surviving one is to have $\frac{1}{2}$ of their shares. Their whole chance is worth \$1260, payable at the end of 10 years. Now what was the sum of money each was to receive, supposing 75 die out of 4010 between the ages of 30 and 40, 82 out of 2448 between 40 and 50, and 80 out of every 1632 between the ages of 50 and 60? A. L. FOOTE.

896. The population of a city is 2,000,000. If births and immigration increase the number 2%, and death and emigration decrease it 1 $\frac{1}{2}$ %, annually, what will be the population in 150 years?

A. M. SCRIPTURE.

897. What is the price per dozen of eggs, when, to give 3 more for 20 cents, would reduce the price per dozen 1 $\frac{1}{2}$ cents?

D. W. K. MARTIN.

898. Three men, named Adams, Brown and Clark, with their sons Daniel, Edward and Francis, have each a piece of land in the form of a square. Mr. Adams's piece is 23 rods longer on each side than Edward's, and Mr. Brown's piece is 11 rods longer on each side than Daniel's. Each man has 63 sq. rd. more than his son. Which of these persons are father and son, respectively?

B. F. FINKEL.

899. Victor was riding with his father through the country. They stopped to rest under the shade of a tree. A village lay directly north of them and another directly east. After leaving the tree they rode 30 miles in a course 35° east of north, and then were equidistant from the two villages. After riding 15 miles farther in the same direction, they were in a direct line with the villages. Now Victor is a young mathematician and wishes to know how many contributors to the *Visitor* can tell him how far apart the two villages are, and how far from each they were when under the tree.

H. A. WOOD.

900. James Evans has a field in the form of a trapezoid; the north and south sides are 20 and 40 chains in length. The distance from the southeast corner to the northwest corner is 70 chains; from the southwest corner to the northeast corner is 60 chains. From these data determine the area of the field.

J. W. PFEIFFER.

901. Suppose a fly lights on the spoke of a carriage wheel 5 feet in diameter, 6 inches up from the ground. What distance will the fly move while the wheel makes one revolution on a level plane?

S. G. CAGWIN, *New London, N. Y.*

902. Suppose a hemispherical vessel 3 feet in diameter were filled with water, and that ice could freeze uniformly 5 in. thick on top and on the inner surface of the vessel, what would be the volume of ice thus formed? EDITOR.

903. From a circular farm of 270 acres, a father gives to his sons equal circular farms, touching each other and the boundary of the farm. He takes for himself a circular portion in the center, equal in area to a son's part, and reserves the vacant tracts around his part for pasture lands and gives each son one of the equal spaces left along the boundary. Required, the number of sons and the amount of pasture land each has.

Id.

Solutions should be received on or before June 5.

Examination Questions.

☞ First set of questions was used April 17, and the second, May 1.

ARITHMETIC.

1. A man after doing $\frac{3}{4}$ of a piece of work in 12 days, employs an assistant, and both complete it in 3 days; in what time could the assistant alone complete it?

ANS.—The man could do the whole work in $12 \div \frac{3}{4} = 16$ days, and both, in $3 \div \frac{1}{16} = 48$ days; it would take assistant $\frac{1}{3} \div (\frac{1}{16} - \frac{1}{48}) = 12$ days to "complete" it.

2. Bought goods on 90 days credit, as follows: April 2, 1853, \$200; June 1, \$300; what is the average time of payment?

Take April 2 as the focal date, and $\$200 \times 90 = \18000 for one day; also $\$300 \times 150 = \45000 for one day. Hence the average time is $(18000 + 45000) \div 500 = 126$ days from April 2, or Aug. 6.

3. I spent \$260 for apples at \$1.30 a bushel; after retaining a part for my own use, I sold the rest at 40% profit, clearing \$13 on whole cost. How many bushels did I buy?

ANS.—I realized $\$260 + \$13 = \$273$ at 140% of \$1.30, or \$1.82 per bushel; hence I sold $273 \div 1.82 = 150$ bu. and retained $(260 \div 1.30) - 150 = 50$ bu.

4. A and B are at opposite points of a field 135 rods in compass, and start to go round in the same direction, A at the rate of 11 rods in 2 minutes and B 17 rods in 3 minutes. In how many rounds will one overtake the other?

ANS.—They are $135 \div 2 = 67\frac{1}{2}$ rods apart, and B gains $5\frac{3}{4} - 5\frac{1}{2}$ or $\frac{1}{4}$ of a rod on A in one minute; hence it will take $67\frac{1}{2} \div \frac{1}{4} = 405$ minutes till B overtakes A. B traveled $5\frac{3}{4} \times 405 \div 135 = 17$ rounds, and A $17 - \frac{1}{2} = 16\frac{1}{2}$ rounds,

5. Ten per cent of 120 is 8 less than 5% of what number?

ANS.—We have $[(120 \times .10) + 8] \div .05 = 100$.

6. If 10 men or 18 boys can dig 1 acre in 11 days, find the number of boys whose assistance will enable 5 men to dig 6 acres in 6 da.

ANS.—It will take $\frac{10}{18} \times \frac{11}{6} \times 18 = 198$ boys, but 5 men's work is equivalent to that of 9 boys, and the required number of boys is $198 - 9 = 189$.

7. Two globes, each 5 inches in diameter, and 2 cubes, each 5 in. in length, were melted into one cube. How long was its edge?

ANS.—The side required is $\sqrt[3]{[(5^3 \times .5236 \times 2) + (5^3 \times 2)]} = 7.24$ in.

8. Sold a cow for \$25, losing $16\frac{2}{3}\%$; bought another and sold her at a gain of 16%. Neither gained nor lost on the two; find their cost.

ANS.—The first cost $\$25 \div .83\frac{1}{3} = \30 ; the second, $\$5 \div .16 = \31.25 .

9. A and B have the same annual income. A saves $\frac{1}{4}$ of his while B, who spends annually \$350 more than A, at the end of 4 years is in debt \$120. What is the annual income of each?

ANS.—B's annual debt is $\$120 \div 4 = \30 , and $\$350 - \$30 = \$320$ is what A saves or $\frac{3}{4}$ of his income. Hence each gets $3 \times \$320 = \960 .

10. Received \$1,009.29 for a note having 60 days to run, discounted in bank at 6%. How much should I have received for it, discounted by true discount at 12%?

ANS.—The face is $\$1009.29 \div .9885 = \1020 ; and the present worth, $\$1020 \div 1.02 = \1000 .

1. What is evolution? Involution?
2. In division of fractions, why invert the divisor?
3. How much can I pay for a note of \$500, due in 3 months, and drawing 8% interest, that I may realize 12% on my investment?
4. A note of \$650 is dated Jan. 1, 1886, and is due one year after date, drawing 6% interest; how much can be paid for it May 1, 1886, that the purchaser may hold it till due and realize 10% on his money?

ANS.—Amount of note at maturity is $\$650 \times 1.06 = \689 ; the sum to be paid is the present worth of this amount for 8 mo. at 10%, or $\$689 \div 1.06\frac{2}{3} = \645.94 .

5. A boat goes 15 mi. an hour down stream, and 10 mi. an hour up stream; how far can it go and return in $12\frac{1}{2}$ hours?

ANS.—To go one mile takes $60 \div 15$, or 4 minutes and to return that distance $60 \div 10 = 6$ minutes; $\therefore$ 10 minutes are required to go and return one mile, and $12\frac{1}{2} \times 60 \div 10 = 75$ mi. is the required distance.

6. What is the area of one side of the largest cube that could be placed in a globe whose diameter is 18 inches?

ANS.—The required area is $18^2 \div 3 = 108$ sq. in. See Vol. 6, p. 164.

7. Reduce $\frac{1}{5}$ to ninths and $\frac{2}{3}$ to a fraction whose numerator is 13.

ANS.—In a unit there are 9 ninths, and in $\frac{2}{3}$ there are $\frac{2}{3}$ of 9, or $7\frac{2}{3}$ ninths. The numerator of the required fraction in second part of question is $4\frac{1}{2}$ times the given numerator; multiplying both terms by $4\frac{1}{2}$ we get $\frac{13}{8\frac{1}{3}}$.

8. Insert 2 geometric means between 5 and 20480.

ANS.—The number of terms is $2+2=4$; hence $\sqrt[3]{(20480 \div 5)} = 16$ is the ratio, and the means are $5 \times 16 = 80$, and $80 \times 16 = 1280$.

9. Insert 4 arithmetical means between 11 and 66.

ANS.—The number of terms is $4+2=6$, and the common difference is $(66-11) \div 5 = 11$; $\therefore$ the required means are $11+11=22$, $22+11=33$, $33+11=44$, and $44+11=55$.

10. How many feet in a board 14 ft. long and 16 in. wide at one end and 10 in. at the other, and 3 in. thick?

ANS.—The average width of board is $(16+10) \div 2 = 13$ in.; $14 \times 13 \div 12 \times 3 = 45\frac{1}{2}$ feet.

NOTE.—For full answers to 1st, 2d and 3d, see p. 82, April *Visitor*.

HISTORY.

1. What faculties of the mind are chiefly cultivated by the study of History?

ANS.—Memory, imagination, reason, and the moral faculties.

2. When and by whom was the cotton gin invented?

ANS.—Eli Whitney, in 1793.

3. Give the date and principal cause of the French and Indian war.

ANS.—England declared war against France, May 17, 1756, and France against England June 9, and they closed by the treaty at Paris, Feb. 10, 1763.

4. Name 5 noted foreigners who assisted us in the Revolution.

ANS.—La Fayette, Rochambeau, Count de Grasse and Count D'Estaing from France; Thaddens Kosciusko and Count Casimir Pulaski of Poland; and John DeKalb and Frederic Steuben of Germany.

5. What was "squatter sovereignty" and who was its author?

ANS.—Stephen Arnold Douglas "The Little Giant" being chairman of the Territorial committee (at first in the House and then in Senate, to which he was elected in March, 1847), it fell to him to introduce the bills for admitting

Iowa, Wis., Minn., Cal., and Oreg. into the Union, and for organizing the Territories of Minn., Oreg., N. Mex., Utah, Wash., Kan., and Nebr. On the keenly disputed question of slavery in the Territories, Douglas advocated, if he was not the first to promulgate, the doctrine of "popular sovereignty," by which each Territory was to be left to decide for itself. California was the first application of this principle, and it decided against slavery. The bill for organizing the Territories of Kansas and Nebraska, which Douglas reported to the Senate Jan. 4, 1854, caused great popular excitement, as it repealed the Missouri compromise and declared the people of "any State or Territory free to form and regulate their domestic institutions in their own way, only subject to the U. S. Constitution." The debate on this bill continued till May 25, when it was adopted. Up to this time the Whigs had held intact their organization, but now they could feel, from their leaders down to the most insignificant tyro in their camp, the wedge of disintegration to the heart of their body politic.

6. Name some of the causes of the American Revolution.

Taxation without representation; Stamp Act; Writs of Assistance; Sons of Liberty; Importation Act; Boston Massacre, Tea Party, and Port Bill; Mutiny Act; Character of George III.; Public sentiment; Patriotism of colonists; and the influence of France.

7. Name the presidents of the United States in their order.

8. Name four each of French, Spanish, and English explorers.

ANS.—*French*: Cartier, La Salle, Champlain and Verrazzani. *Spanish*: Columbus, Balboa, Magellan and De Soto. *English*: Cabot, Drake, Raleigh and Frobisher.

9. When and where was the first permanent settlement made in the United States? In Va.? In N. Y.? In Ohio? In Mass.?

ANS.—St. Augustine, Sept. 8, 1565, by Menendez. Jamestown, May 13, 1607, by 105 persons from England. New York (Manhattan), in 1613, by the Dutch. Marietta, April 7, 1788, by 60 persons under Gen. Putnam. Plymouth, Dec. 21, 1620, by the Pilgrims.

10. In what three ways may a bill become a law?

ANS.—By concurrence of Congress and President. By neglect of President to file objections within ten days. Over President's veto by two-thirds of both branches of Congress.

1. Give date and location of the first two English settlements in the United States.

2. When was the constitution of the United States adopted in general convention? What States did not adopt it until after the Presidential election?

ANS.—Adopted Sept. 17, 1787. N. C. and R. I.; the presidential election held first Wednesday in Jan., 1789. Electors (69) voted first Wednesday in Feb.

3. In whose administration and when was Louisiana acquired? Florida? Texas? California? Alaska?

ANS.—La. in Jefferson's, April 30, 1803. Florida in Monroe's, Feb. 22, 1819. Texas in Polk's, July 4, 1845, and Cal., Feb. 2, 1848. Alaska in Johnson's, May 20, 1867.

4. What was the ordinance of 1787? The Kansas-Nebraska bill?

REFERENCE.—Full answer to first, p. 223, Vol. 6, and to second, p. 215.

5. Name the Presidents not chosen by the Electoral College; and those that died in office.

ANS.—Jefferson, J. Q. Adams, Hayes. Harrison, Taylor, Lincoln, Garfield.

6. During whose administrations have accessions been made to our territorial limits?

7. Give an account of DeSoto.

Ans.—He was a brave, hardy Spaniard, of the sordid type of Pizarro or Cortez, born in Estremadura, Spain, about 1500. His earliest exploits were performed under the eye of his dear friend Pizarro, and at the fall of Cuzco, he distinguished himself above all others by his gallantry in capturing the famous Inca of Peru, Atahualpa, Nov. 16, 1532, and DeSoto shared in the rich spoils wrung from him. Here, was the far-famed Temple of the Sun, upon whose eastern wall flamed a golden image of that luminary, worth millions of dollars. Returning to Spain, laden with these spoils, DeSoto fitted out an expedition of 600 men and 300 horses, with which he intended to reach the interior of North America. In the mean time he won his wife with Peruvian gold, not the love of the noble woman, but it was necessary to purchase the consent of her mercenary father. He sailed in 1538, and touching Cuba, left his wife in command there, and arrived in Florida, May, 1539. Landing his men, horses and bloodhounds, he went to the Flint River; thence to Mavilla, now Mobile, where a fierce battle raged for hours; at last the large Indian town was set on fire, and those Indians who had escaped the swords, bullets and battle-axes of DeSoto's men, perished in the flames. Over 2500 Indians were here destroyed. Ambushed by hostile parties and suffering great difficulties, the explorers moved westward, and in May, 1541, they discovered the Mississippi. The grandeur of their discovery does not seem to have impressed them, other than with a sentiment of disgust that it was difficult to ferry. They crossed into Arkansas, and wandered through the wilds and worn down by exposure, the torments of gnats and mosquitoes, and the attacks of fatal fevers, they rested at the mouth of the Red River. Here DeSoto took sick, and after appointing Moscosco leader of his band, he bade them adieu, submitted himself to the ghostly offices of the priest and passed quietly away, May 21, 1542. Desiring to conceal his death, they wrapped his body, clad in its ponderous armor, in a winding sheet, and weighting the latter, they pushed off in a light canoe at midnight, and committed the corpse to the murky waters of the great river. A solitary link-man, with a single torch, a priest with his spotless robes and gilded crucifix, and a half dozen trusty followers, formed the funeral cortege of the ill-fated adventurer. It was three years before the news of her husband's death reached the noble Donna Anna, and in three days she died, a victim to grief for one, whatever may have been his faults in the eyes of others, to her was ever a gallant hero, and the object of her undying affection. She truly died of a broken heart.

8. Give an account of the laying of the Atlantic cable.

Ans.—A line of soundings on the Telegraphic Plateau was commenced in October, 1851, by the U. S. brig *Dolphin*. The first attempt to lay the cable was commenced Aug. 5, 1857, at Valentia, Ireland, by means of the British ships, *Leopard* and *Agamemnon* with the American ships *Niagara* and *Susquehanna*. After mending a few breaks, they succeeded to lay 300 miles, when a break occurred and the enterprise was abandoned. It was resumed the next year and this time success crowned the effort. Aug. 17, 1858, Queen Victoria sent a message of congratulation to President Buchanan, who replied with a similar sentiment. But no successful communication could afterwards be effected. It was not till July 27, 1866, that the *Great Eastern* succeeded in laying a strong flexible cable side of the other one, which has proved a perfect success ever since. The first message over this one announced peace between Prussia and Austria. We believe there are now five cables across the Atlantic.

9. What was the Credit Mobilier?

The *Credit Mobilier of America* was organized in May, 1863, as a joint stock company with a capital of \$2,500,000 to do a banking business, but in January,

1867, it sold the charter to a company of speculators which proposed to build the Union Pacific Railroad. The capital stock was then raised to \$3,750,000. It became evident that this company distributed the stock of that road among prominent U. S. officials to secure favorable action of Congress. The first revelation of the matter was made by a lawsuit in Pa. in 1872. The country became amazed, and a prolonged and intense excitement attended the investigation by a committee of Congress. The chief witness in this case was Oakes Ames, whose "little memorandum book" was his chief reliance in verifying his transactions in managing the stock. The report of the committee, made Feb. 27, 1873, recommended the expulsion of one Senator, but the action was not taken. Oakes Ames and James Brooks of the House, were censured. See *School Visitor*, Vol. 4, No. 4, p. 79.

10. What ex-Vice-President was tried for treason?

ANS.—Aaron Burr. His conspiracy, arrest and trial is explained in connection with Blannerhasset, given at length on pp. 40 and 41, Feb. *Visitor*.

GEOGRAPHY.

1. Define the three branches of Geography.

2. Give three or more reasons for believing that the earth is round.

ANS.—(1) Men have sailed round it; (2) Its shadow on the moon in lunar eclipses; (3) Appearance of ship at sea; (4) Appearance of clouds at the horizon; (5) Analogy.

3. What is a great circle? A small circle? A meridian circle? The prime meridian?

ANS.—A *Great Circle* divides the surface of the sphere into two equal parts. A *Small Circle*, into unequal parts. A *Meridian Circle* is a great circle, drawn round the sphere through each pole. The *Prime Meridian* is the meridian of Greenwich, *prime* meaning *first*.

4. What is the Solar System?

5. What are the natural divisions of time?

ANS.—Day and night.

6. Define and locate the zone of calms; the zones of the trade winds, and the zone of variable winds and account for each.

ANS.—The tract of low pressure atmosphere between the north tradewinds which prevail between latitudes 7° and 30° N. and the south trades between latitudes 3° N. and 25° S., is named the *zone of calms*, owing to the *calm* weather which often prevails there. This region of the calms varies its position with that of the sun, reaching its most northern limit, lat. 11° N., in August, and its most southern, lat. 1° N., in February. Its breadth varies from 3° to 8° , and it lies generally parallel to the equator. Note that in the Atlantic and eastern portion of the Pacific the region of the calms is at all seasons north of the equator. But owing to the low pressure in the interior of Australia during the summer months, and the extraordinarily high pressure in Asia, the zone of calms extends considerably south of the equator. Outside of these regions we have the zone of variable winds. The cause of all winds is reducible to a single principle; viz., the principle of gravitation. From regions where pressure of atmosphere is high, *i. e.*, where there is a surplus of air, winds blow in all directions; and towards regions where there is low pressure, *i. e.*, a deficiency of air, winds blow from all directions in an in-moving spiral course.

7. Name forty counties in Ohio.

8. Name the townships in Darke county.

9. Locate the Cumberland mountains. Describe the Cumberland river.

10. Name the Gulfs and Bays on the coasts of the U. S.

1. Write a topic list for the full geographical discussion of Ohio.

Ans.—*Position*—location and boundaries; *Form*—outlines, rivers and lakes; *Size*—Absolute and relative; *Surface*; *Climate*, temperature, moisture and winds; *Soil*, its formation and chemistry; *Productions*, animal, vegetable, mineral, and manufactured articles; *Occupations*, industries and professions; *Capital*; *Cities and Towns*; *History*, mounds, Indians, settlement, admission, progress; *Government*, its constitution, officers, eleemosynary institutions, schools, and public works; *Miscellaneous*.

2. Between what parallels of latitude is the United States?

3. Define zone, great circle, tropic, climate, and ecliptic.

Ans.—*Zone* signifies a *belt* or *girdle*, as applied to climatic and to mathematical divisions of the earth's surface; they encompass the earth like a *girdle*.

Tropic means *return*, for when the sun is over one of the tropics, it appears to stop and retrace its course. When the sun is over the Tropic of Cancer, June 21, we have the *Summer Solstice*, and when it is over the Tropic of Capricorn, Dec. 21, we have the *Winter Solstice*. When the sun crosses the Equator March 20, we have the *Vernal Equinox*, and Sept. 20, the *Autumnal Equinox*.

Climate has reference to the condition of the atmosphere with regard to heat and moisture, and depends upon latitude, altitude, prevailing winds, length of day, ocean currents, mountains, distribution of land and water, nature of the soil, slope of the land, and forests.

4. What are steppes, and where found?

Ans.—Great plains in Siberia.

5. Draw an outline map of Ohio, locate five rivers and five cities.

6. What is a republic? What countries have republican form of government?

Ans.—*United States*, 38 states and 10 territories; *Mexico*, 27 states, one federal district and territory of L. California; *Guatemala*, *Honduras*, *San Salvador*, *Nicaragua*, *Costa Rica*, *Argentina*, *Bolivia*, *Chili*, *Ecuador*, *Paraguay*, *Peru*, *Uruguay*, *Columbia*, *Venezuela*, *France*, *Switzerland*, *San Marino*, the smallest and oldest in the world, *Andorra*, *Orange River Free State*, *Liberia*, and *Sierra Leone*.

7. Name principal tributaries of the following rivers: Danube, Amazon, Mississippi.

8. If the Black and Caspian seas were connected by a channel, what effect would be produced?

Ans.—Since the surface of the Caspian is nearly one hundred feet lower than that of the Black Sea, it would produce quite an effect to raise the Caspian to the level of the Black.

9. How many degrees from the north pole to the antarctic circle?

10. Bound the Atlantic Ocean.

SPELLING.

Guerrilla	auxiliary	initiate	composite
amateur	excel	tricycle	Louisiana
caucus	waltz	pickeral	condescend
repel	serge	secede	succinct
cruise	serf	indelible	Yucatan

We did not receive words used April 17.

GRAMMAR.

1. Of what does poetry consist, and how does it differ from prose?

Ans.—It consists of metrical language, arranged with reference to accented syllables, and differs from prose in this respect.

2. Is the subject of a verb ever in any other case than the nominative? If so, when?

Ans.—The subject of a finite verb is always in the nominative case.

3. What parts of speech are inflected?

Ans.—Adjective, noun, pronoun and verb.

4. Write a sentence containing a complex objective element of the third class.

Ans.—The boy said, "We bought the piano when the agent arrived."

5. Give synopsis of *forsake* in the passive voice.

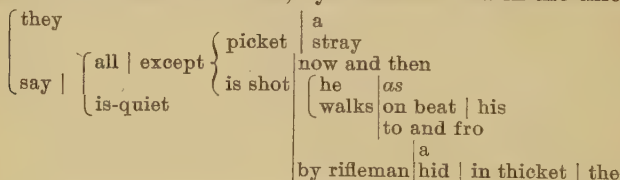
6. Define tense, and give tenses of each mode.

7. What is expressed by the different modes of the verb?

Ans.—The relation of reality or existence as conceived of by the speaker, or the modes represent the conceptions and affections of the mind. Hence grammarians differ as to the number of modes, as well as languages, in this respect. It is said the Arabic has 13 modes, the Russian 7, the Sanscrit 6, etc. The English might have the *Indicative, Subjunctive, Potential, Optative, Imperative, Infinitive, Vocative, Precative, Interrogative, Casual, Reflective, etc.*

8. Give five rules for the use of capital letters.

9. Diagram and parse words in italics: "All *quiet* along the Potomac," they say; "except, now and *then*, a stray picket is shot, *as* he walks on his *beat* to and fro, by a rifleman *hid* in the thicket."



1. In what ways are nouns used in the absolute case? Give example.

2. What are the properties of a part of speech?

Ans.—The properties of a part of speech are what belong to it.

3. Write a sentence with a complex element of the third class used as the subject of the sentence.

Ans.—*What the result may be of the conflict that now rages between capital and labor*, is a subject for serious reflection.

4. When does a common noun become proper? An intransitive verb transitive?

Ans.—A common noun becomes proper when it is used to distinguish one individual from another of the same class, and *vice versa*, when a proper noun assumes a meaning that it can be applied to each individual of a class. An intransitive verb becomes transitive when it requires an object to complete its meaning.

5. What parts of speech are used as subordinate connectives?

Ans.—Pronouns, adverbs, and conjunctions.

6. In what respect does *what* as a relative differ from other relatives? When is *what* used?

Ans.—In its two-fold function, representing two constructions. It is used at the pleasure of the speaker or writer.

7. Write a sentence in which a clause is the antecedent of a pronoun.

Ans.—*The boy closed the shutters, which darkened the room.*

8. What is voice? To what verbs applied? How is the passive voice found?

Ans.—*Voice* is a particular form of the verb, indicating the relation of the subject to the action expressed by the verb. The *Active Voice* represents the subject as the agent or doer of the action expressed. The *Passive Voice* represents the subject as the object affected by the action. Taking these definitions as correct, voice should be applied to both transitive and intransitive verbs. Consult Goold Brown, Webster, Henkle's *Notes and Queries*, etc.

9. Parse italicized words:

I was writing a letter *when* my friend came. Boys love *to swim*. He was anxious *to secure* the position. The children came *hurrying* home from school. He came *as* an interpreter. He *ought to be made go*. Much *is to be said* on the subject. We want *him* to go.

Ans.—*Was writing* is a verb, progressive form, and *when* is a conjunctive adverb, modifying *came*.

To swim is a verb, infinitive mode, and most authors would give it the construction of a noun, object of *love*. Goold Brown, however, considers the verb intransitive that takes the infinitive after it. There is really a vast difference in the relation of the subject to the action expressed in—*Boys love to swim* and *Boys love the girls*. Change to the passive—*To swim is loved by the boys* and *The girls are loved by the boys*. The passive form shows the distinction.

To secure has the construction of an adverb, modifying *anxious*.

Hurrying is a participle, with the construction of an adjective, in the predicate with *came* and refers to *children*. Compare with—*He came tripping* lightly over the floor, *She came weary and careworn* to her daily task, and *She returned laughing and chatting* with her playmates.

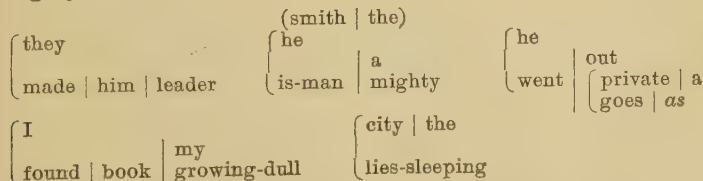
As may be parsed as a conjunctive adverb modifying *would come* understood.

Ought is a defective intransitive verb; *to be made* and *to go* are infinitives both having the construction of adverbs, modifying the verbs preceding.

To be said has the construction of an adjective, in the predicate with *is*, and refers to the subject.

Him is the object of *want* and *to go* has the construction of an adjective, limiting *him*.

10. Diagram: They made John leader. He went out as private. The city lies sleeping. I found my book growing dull. The smith, a mighty man is he.



We consider *leader* the attributive object of *made*. They made him *sick*; here *sick* is the attributive object, but it modifies *him*.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

Joel Dorman Steele, the author of Barnes's popular histories, and a series of excellent scientific works, obtained answers for us to queries 881 and 911, for which the editor and the whole *Visitor* family are truly grateful. They contain rare and valuable facts. Prof. Thorpe is one of Mr. Steele's friends.

In several respects we consider Barnes's Brief Histories the best published. They are not "chaffy," but give much in little space.

876. What commander said, "Spare the soldiers, but slay the gentlemen"?

Ans.—About the middle of the 15th century, occurred in England the war known as the Wars of the Roses. It lasted from 1455 to 1485, a period of 30 years. It ended the Plantagenet Line, which had ruled England for three centuries, and established the new house, called the Tudor Line. The result of this Civil War was the triumph of the kingly power over the aristocracy. It was a war of nobles and their military retainers. Both sides protected the neutral citizens, but were bent on exterminating each other. No quarter was asked or given. When Edward IV. galloped over the field of battle after the victory, he would shout, "Spare the soldiers, but slay the gentlemen." During the war, eighty princes of the blood and two hundred nobles fell by the sword, and half the families of distinction were destroyed. The power of the great barons gone, the King had little check, and the succeeding monarchs ruled with an authority never before dreamed of in English history.

H. A. WOOD.

881. What states passed "Personal Liberty Laws"?

W. F. L. SANDERS, Author of *The English Sentence*.

Ans.—The "Personal Liberty Bills" were passed by the following states:

Maine, New Hampshire, Vermont (1843-1850-1858), Massachusetts (1843-1860-1861), Connecticut, Rhode Island, New York (1840), New Jersey, Pennsylvania (1860), Michigan (1861), and Wisconsin.

Authorities—The National Intelligencer of Dec. 11, 1860; McPherson's Political History of the United States, 1860-64, p. 44; Brook's "Laws in Relation to Fugitives from Justice," printed at Washington by Taylor & Maury, 1860.

FRANCIS N. THORPE.

892. What is meant by *chain navigation*?

PREBLE.

Ans.—In shallow rivers with rapid currents, as the Elbe in Germany, a strong chain is sunk, firmly anchored at both ends. This chain, lifted out of the water, passes over rollers from the bow of the steamer to the middle of the deck, where it passes around two steel drums, each provided with grooves and the chain passes three times around each. Finally the chain descends into the bottom of the river from the stern of the steamer. The chain steamer to which are attached heavily laden boats, is thus constantly at anchor going up stream and firmly resists the current.

The weight of the chain placed in the Elbe River exceeds 22,500,000 lb., each link weighing over 2 lb. About ten freight vessels are attached to a chain steamer at Hamburg, and she takes the train of boats up the river until another meets her to relieve her of the load. There are about thirty such steamers in the Elbe.

An experiment was recently made on the canal from Antwerp to Liege with a system of mechanical traction of boats by means of a movable cable made of Bessemer steel, kept in motion by stationary engines along the banks. This is also successful.

EDITOR.

893. How was gold discovered in California?

Id.

Ans.—A piece of gold was picked up in a mill race on a branch of the Sacramento River, by a little girl named Marshall, daughter of the overseer of the mill, which belonged to John A. Sutter. The men were repairing the race. The lump was known by part of them to be gold, and they tried to keep it a secret but in some way it spread, until the whole country was excited, and thousands poured into California. Gold was noticed in California by persons with Drake in 1577, and different Spanish writers subsequently affirmed the richness of the region in minerals.—*America*.

A. F. PRAEEL.

In *Conquering the Wilderness* by Col. Triplett, we find that the discovery was made by James W. Marshall, Jan. 19, 1848, in the sand washed by the current through the mill-race he was digging. "Convinced that it was gold, Marshall showed it to Sutter, who only laughed at him. This ridicule had no effect on Marshall, who in Feb. 1848, took some of the 'stuff' to San Francisco, where it was seen by Isaac Humphrey an old miner from Georgia." Humphrey started at once to the "Diggings" and succeeded at once in striking "pay dirt." The mill hands stopped their work and each made from \$5 to \$50 a day at the diggings. The location was at a place called Coloma, on the American River, some 50 miles east of Sacramento.

EDITOR.

894. Give a sketch of the life of Kit Carson.

Id.

Ans.—In 1826, Kit successfully amputated an arm of one of the teamsters in the train he accompanied to Santa Fe, where he learned the Spanish language. He died at Ft. Lyon, Col., May 23, 1868, from a rupture of an aneurism of one of the arteries of the neck. The rifle, with which he had won so many victories over savage foes, now hangs in the Masonic Hall of Montezuma Lodge in Santa Fe, of which Kit was a member.

EDITOR.

Christopher Carson, by his countrymen familiarly called Kit Carson, was born in Madison Co., Ky., Dec. 24, 1809. The Carson family were among the first settlers in Kentucky, and became owners of fine farms. Besides being industrious and skillful farmers, they were noted hunters and Indian fighters. The father of Kit was known to be one of the greatest men of Kentucky. Kit Carson was one of those pioneer boys, who began to make his mark early in life. He learned the saddler's trade, and at the age of 15 was considered by every one a man.

GEO. L. SHANER.

Christopher (better known as Kit) Carson, was born in Ky., in 1809, and died in Col., 1868. He was one of the most famous pioneers and scouts of the west. When about 24 years old he was appointed hunter to Bent's Fort, where he remained eight years; he was then engaged as a pioneer in Fremont's explorations among the Rocky Mountains. In 1847 he was made lieutenant in a rifle corps of the regular army. In 1853 he drove 6,500 sheep over the plains and mountains to California. He was afterward Indian agent in New Mexico, and was instrumental in making a number of important treaties. In the civil war he did good service on the borders, and was brevetted Brig. Gen. The remarkable adventures of Kit Carson often surpass the most extravagant romance though the most daring of them are literally true. Personally he was as modest as he was brave.

J. H. W. SCHMIDT.

895. Describe the Fort Alamo Massacre.

Id.

Ans.—Mexicans under Santa Anna were besieging the fort held by 550 Texans under Travis. The Texans received no help excepting 320 volunteers from Gonzalez. Travis said "we never intend to surrender or retreat." Meanwhile the enemy had increased to 4,000. Santa Anna, on March 6, surrounded the fort and twice were repulsed in their attempt to scale the walls, in the third attempt they tumbled over the wall like sheep. Then commenced the last struggle. Travis received a shot while standing on the walls cheering his men. As he fell a Mexican officer rushed to dispatch him, when Travis summoning his failing powers, thrust his sword upward and both expired together. Unable

from the crowd and want of time the Texans clubbed their rifles, and continued to fight. One only remained to ask for quarter which was denied him. Of all the persons in the place Mrs. Dickerson, her child, and a negro were spared. The storming lasted less than an hour. Major Evans was shot. David Crockett was found dead. Col. Bowie (inventor of the Bowie knife) was murdered in bed. The bodies were stripped and thrown in a heap and buried. Mexican loss was from 1000 to 1500. Never was a defence more heroic, and has scarcely been equalled, save at the Pass of Thermopylae. PHEBE SHIVES.

James Bowie was on his cot dying of consumption, but at the storming he shot two and stabbed three of the murderers before his gallant spirit took its flight from that frail tenement, now pierced by nearly a hundred wounds. David Crockett likewise fought like a lion and died like a hero. Around his mangled body lay the corpses of a dozen of the enemy who had fallen by his single hand. At the entrance to the State House at Austin, Texas, stands a monument to the heroes of the Alamo—Wm. Barrett Travis, David Crockett, James Bowie and Bonham.

EDITOR.

896. What was the Mountain Meadow Massacre?

Id.

Ans.—In 1849, the Mormons formed the State of Deseret, and knocked for admission at the door of the Union. This they did not obtain, but their State was made into the Territory of Utah in 1850, and Brigham Young appointed governor. This unwise action of Filmore, enabled that unscrupulous scoundrel to arrange the internal affairs of the territory, that the U. S. laws had been a dead letter therein ever since. These Danites became fanatical assassins, and when a gentile would obstruct the plans of the sensual governor, under the guidance of the "avenging angels," the offender would soon "go over the rim of the basin," and his mouldering remains could be found in some lonely gulch, and the murder was charged to the Indians.

The most horrible of all their crimes, one which dwarfs the massacres of the border Indians for cold-blooded barbarity and infernal cruelty, was the "Mountain Meadow Massacre." In 1857, while on their way to California, 132 Arkansas emigrants attempted to pass through Utah. They met with hostility, and were unable to obtain food for themselves and their stock. Being weak from exposure and starvation the party encamped at Mountain Meadows where there were luxuriant grass and magnificent springs of fresh water. This camp they never left. Under direction of Young, the fanatical Lee, Higby and Klingensmith, with 58 Mormons and about 350 Indians attacked these emigrants at daylight, on Tuesday morning, Sept. 13, 1857, killing 7 and wounding 16. The party fought bravely and repulsed the enemy. The wagons were placed in corral shape, closing the gaps by locking the wheels together with chains, and within was dug a rifle pit for the women and children. For four days the Arkansans were cooped in the fatal corral, under the furious fire of the fiendish besiegers day and night. On Friday the ammunition was nearly exhausted and two little boys came out with a flag of truce, but Lee repelled them. In the evening Lee and another wretch advanced with a flag of truce, and Capt. Fancher commander of the camp, met them. When Lee entered the camp, he found all there except ten, who were buried in the corral. It was agreed that the emigrants should surrender their arms, and under protection of the Mormons be conducted beyond their borders. A long train was formed and the procession advanced. At the fatal words, "Do your duty," from Higby, a scene of horror followed seldom equaled in the annals of the human race. At the first fire nearly all the defenseless men were shot, and the rest pursued and cut down. Tender children, gentle girls, wives, maidens and mothers, were ruthlessly butchered. See *Conquering the Wilderness*.

J: D. Lee was convicted as leader of the massacre and shot March 23, 1877, on the scene of his crime. Brigham Young was the most guilty, but escaped to die Aug. 29, '77, as he had lived, the victim of his appetites, from eating an enormous mess of green corn and half-ripe peaches.

EDITOR.

897. Give incident and name of the only steamboat that went down the Niagara River below the Falls, and over the whirlpool, without loss of life. VAL.

Ans.—The little steamer “Maid of the Mist” was the only one that ever made the passage of the whirlpool. She was used to run from her dock near the Railway Suspension Bridge up to the Falls, passing so close to the falling waters as to seem to those looking down upon her, to almost pass under the sheet. Water-proof garments were provided, and the trip was an exciting one. The steamer was built expressly for this brief voyage, being an excellent boat of 170 tons burden, with an engine of above 100 horse-power. The owners having found her unprofitable, she was sold to a Montreal firm, with the condition that she should be safely navigated through the Rapids and Whirlpool. This dangerous experiment was undertaken by Joel R. Robinson. (The Hero of Niagara) with two assistants—McIntyre and Jones. She left her moorings, near the Bridge, June 15, 1861, and swung boldly out into the river, to try one of the most perilous voyages ever made. She shot forward like an arrow of light, and with the velocity of lightning passed on, as many supposed, to meet her doom. Many beheld this hazardous, daring adventure, expecting every instant she would be dashed to pieces and disappear forever. Amazement thrilled every heart, and it appeared as if no power short of Omnipotence could save her. But guided by an eye that dimmed not, and a hand that never trembled, she was piloted through those maddened waters by the intrepid Robinson in perfect safety. The boat lost her funnel, but otherwise, received no injury.—*Tugby's Guide to Niagara Falls.* J. H. W. SCHMIDT.

898. What was the treaty with China in 1845? S. B. KECKLER.

Ans.—Jan. 10, 1845, the Senate ratified a treaty with China, negotiated by Caleb Cushing, of Mass., with the Governor General Tsiyeng on behalf of the Emperor Taon Kuang. By this our relations with China were placed on a more favorable footing than ever before. D. B. LECKLIDER.

899. Who invented phonography? D. W. K. MARTIN.

Ans.—Phonography was invented by Isaac Pitman, of Bath, in 1837; since that time, however it has been considerably modified. MYRTLE GEORGE.

900. Why are two light woolen garments warmer than one heavy one? Id.

Ans.—Two light woolen garments are warmer than one heavy one, as there is between them a layer of non-conducting air. S. J. BROWN.

901. Where is “Black Hole of Calcutta.” and for what is it noted?

Ans.—Black Hole, a small close dungeon in Fort William, Calcutta, in which on the capture of Calcutta by Surajah Dowlah, June 30, 1756, the British Garrison, consisting of 146 men, under the command of Mr. Holwell, were locked up for the night. It was a room 18 feet square. It contained only two windows. In a short time their suffering from thirst and the foul air became terrible; and in a few hours several died. Only 23 survived till morning. It is now used for a ware house, and an obelisk 50 ft. high, erected in memory of the victims stands before the gate. J. D. BEARD.

902. By whom was the Constitution of the United States written? Who was known as “The Expounder of the Constitution?” Id.

Ans.—Gouverneur Morris prepared the Constitution of the U. S. in the form adopted by the Convention, in 1787. He was a brother to Lewis, one of the signers of the Declaration of Independence. He was born at Morrisania, N. Y., Jan. 31, 1752. His Father's death left him to the care of his mother at the age of 12. He was a graduate at King's College, New York City, May, 1768, admitted to the bar in the Autumn of 1771, elected in 1775 to the New York Provincial Congress he was made assistant financial Agent with his namesake

in Phila. He was now a permanent resident of that city, where he lost a leg by being thrown from a carriage. He was a delegate from Pa. in the convention that framed the constitution, and when the various articles had been discussed and adopted, the task of putting the whole instrument in proper form and language was entrusted to Mr. Morris.

After this he resided in Paris till 1790, then went to London as private agent for Washington; in 1792 was appointed plenipotentiary to France; returned to America in 1798, and retired to private life at Morrisania. He early appreciated Jesse Hawley's plan for the Erie Canal. Died, Nov. 6, 1816.

Daniel Webster was the expounder.

J. W. KECKLER, *Ada, Ohio.*

903. When was the Ballot-Box first used in the U. S. ? *Id.*

Ans.—The first ballot voting by slips of paper was used at the general election in Massachusetts Bay colony, in May of 1635, and was ordered to be used thereafter.

CHAS. W. BIGLER.

904. What do astronomers say of the length of days and nights, and of the seasons of Jupiter ?

GEO. L. SHANER.

Ans.—Jupiter's axis is only inclined $3^{\circ}6'$ and this is too small to make any considerable change of seasons. The phenomena of constant day and night take place, therefore, only within two small circles extending $3^{\circ}6'$ from the poles. Exactly at the poles the day and night are alternately about six years long. The cold at the parts of Jupiter must be intense beyond any that we can conceive. The long absence of the sun, and its never rising more than $3^{\circ}6'$ above the horizon, joined with the immense distance of the planet from the luminary, must all combine to intensify this rigor.—Kiddel's Astronomy.

B. F. FINKEL.

905. Where and what is the Telegraphic Plateau? Why so called.

M. A. BROWN.

Ans.—It has been ascertained by Captain Berryman, that between Ireland and Newfoundland the bed of the Atlantic ocean forms a level expanse, about 400 miles wide, and in no place exceeds 13000 feet in depth, covered with the broken shells of minute marine animals. From the fact that on this bed now rest those wondrous cables which unite the Eastern and Western Hemispheres, it is termed the Telegraphic Plateau.

D. W. K. MARTIN.

906. Did Garfield and Arthur get one electoral vote in Cal., 1880? Explain.

J. S. HOYMAN.

Ans.—The contest between the republicans and democrats was so close that it required the official vote to determine the choice of electors at this election. The issue finally centered upon the two nominees for electors-at-large. Owing to local differences, Judge Terry (democrat) ran over 500 votes behind the republican candidate, Mr. Egerton. The five other democratic electors were chosen by small majorities.

H. G. THOMAS.

907. Why is a toper's nose red ?

W. S. DAVIDSON.

Ans.—The toper's nose is red because the capillaries have become diseased from the effects of drinking too much alcohol.

S. J. BROWN.

The effect of alcohol is to increase the pulsations of the heart, consequently the blood surges through the body with increased force, every capillary tube in the system is swollen and flushed like the reddened face and nose, in time this condition of the capillaries become chronic and we see the signs of it in the red nose and fiery face of the toper.

FOREST BALES.

908. At what altitude will water boil at 180°F. ?

Id.

Ans.—The temperature of boiling water varies in consequence of different atmospheric pressures at various altitudes. The variation is about 1°Fah. in about 533 feet altitude; hence water will boil at 180° at an elevation of 17,056 feet. Dr. Hooker tested this on Donkia in the Himalayas, at an elevation of 18,000 feet the water boiled at 180° .

M. W. HOLLINGER.

909. Who was known as the "Hair buying general"?

Id.

Ans.—The British General Hamilton, at Detroit. He offered rewards for scalps, and hence the name.

GEO. L. SHANER.

I would answer Henry A. Procter, a British general of the "War of 1812." I derive the answer from the following lines found in an old history of Ohio:

Freemen, no longer bear such slaughter,
Avenge your country's cruel woe,
Arouse and save your wives and daughters,
Arouse and expel the faithless foe.

CHO.—Scalps are bought at stated prices,

Malden pays the price in gold.

Malden was a British post which fell into the hands of the Americans Sept. 27, 1813.

S. B. KECKLER.

910. Who first used the "Pocket Veto" and for what?

W. F. L. SANDERS.

Ans.—In 1830 Congress passed a bill authorizing a Government subscription to the stock of the Maysville Turnpike Road in Ky. The President believing that Congress had no power to pass such a law, vetoed it. Two days before the adjournment of Congress two bills similar to that of the Maysville Turnpike bill were passed. The President could legally retain them for ten days before signing them. He did so, and in the interval came the day previously fixed for the adjournment of Congress, while the bills remained, as it were, in the Presidents pocket, without force of law. This new method of veto, angrily called a *Pocket Veto* was employed by the President, (Andrew Jackson) on several occasions, afterward.—See Henry's "Voice of the People."

ALBERT DAVISON.

911. Give names and location of the "pet banks."

Id.

Ans.—The "pet banks" were the state banks chosen by Jackson to receive the deposits after their removal from the U. S. Bank. They were—

The Girard at Philadelphia; Common-wealth and Merchants at Boston; Manhattan, Mechanics and The Bank of America at New York; Union at Baltimore; Metropolis at Washington, D. C.; Virginia at Richmond; Branch of Virginia Bank at Norfolk; Planters' at Savannah; Union and Commercial at New Orleans; Maine at Portland; Commercial at Portsmouth, N. H.; Alabama at Mobile; Planters' at Natches, Miss.; Union at Nashville, Tenn.; Franklin at Cincinnati, Ohio; Burlington at Burlington, Vt.; and the Farmers' and Mechanics' at Hartford, Conn.

Authority:—Report of R. B. Taney, Sec'y of Treasury, Dec. 4, 1833; Ex. Doc., No. 2, Vol. I., 1833-34.

FRANCIS N. THORPE.

912. When and where was the first bank established? The first national bank incorporated?

H. A. WOOD.

Ans.—The first bank in the U. S. was chartered March 1, 1780, in Pennsylvania and was called the Bank of Pennsylvania. The Bank of N. A. was chartered Dec. 31, 1781, with a capital of about four hundred thousand dollars. It was the intention of its supporters that this bank should aid the government in its arrangements for the pay of the army. It began business Jan. 7, 1782, and was a very great assistance until the end of the war. Its first president was Thomas Willing. This bank is now in existence as a national bank.

ALBERT DAVISON.

The recently discovered monuments of ancient Babylon contain evidence that banking flourished in the Assyrian empire at least six centuries before Christ. In the reign Nabupal-assar there was an important banking-firm by the name of Egibi & Son, which was a sort of National Bank of Babylonia.

Several tablets have been discovered containing the records of their business, and also a document which is proved to have been the bank almanac of the firm.

In 1171 at Venice, Italy, originated the first bank concerning whose organization and subsequent operations we have any clear knowledge. This bank enjoyed a great reputation in the commercial world, and continued its functions until 1797, when it fell a victim to the ambition of Napoleon. In connection with this, we must mention the Bank of St. George, a Genoese institution established over half a century after the Bank of Venice, but which is considered the "cradle of modern commerce, modern banking schemes, and modern wealth." Its history is wonderful, and "It is melancholy," says Bent, "to have to draw a veil over this illustrious bank with the French Revolution in 1798.

We think the first national bank was the Bank of Sweden founded in 1656 by a Swede named Palmstruck. This bank was a national concern and the inventor of the bank-note in Europe.

The first bank in this country was the Land Bank, in Massachusetts granted in 1686, and the first National Bank under the U. S. System was chartered Jan. 1, 1862, but we can not locate it.—See *Encyclopedia Americana*. EDITOR.

913. Is a cent the same as a penny?

Id.

ANS.—A penny is an English copper coin worth $\frac{1}{40}$ of \$4.8665 = 2 cents, nearly. The penny was formerly a silver coin, first struck in England by the Saxons.

GEO. L. SHANER.

914. What presidents were elected without a majority of the popular vote.

EDITOR.

ANS.—The first popular vote accurately known, was in 1824, when Adams received, 105,321; while Jackson, Crawford and Clay received, 246,740. Election of 1856 popular vote for Buchanan, 1,838,169, for Fremont and Fillmore 2,215,798. In 1860 Lincoln received 1,866,352 and Breckinridge, Bell and Douglas received 2,810,501. In 1876 Hayes received 4,033,950, Tilden, Cooper, Smith and scattering, 4,378,783. In 1884, Cleveland received 4,913,248, Blaine, Butler and St. John, 5,132,830. Thus making Adams, Buchanan, Lincoln, Hayes, Garfield and Cleveland elected without a majority of the popular vote.

JOHN FITZGERALD.

915. Name three towns in Colorado over 9000 ft. above sea level.

G. W. SCHAFER.

ANS.—Leadville, Kokomo and Dolores, are the three towns in Colorado over 9000 feet above sea level.

S. J. BROWN.

917. What were the last intelligible words of John B. Gough? F.

ANS.—The last intelligible words of John B. Gough were as follows: "I have seven years in the record of my life when I was held in the iron grasp of intemperance; I would give the world to blot it out, but, alas! I cannot. Therefore, young men, make your record clean."

ED. RYNEARSON.

918. Who is Laura D. Bridgman?

M. R.

ANS.—Laura Bridgman is a blind mute who was born in Hanover, New Hampshire, in 1829. She was a bright, intelligent child, but at two years of age was seized with a violent fever, which utterly destroyed both sight and hearing. When her health was restored, she had almost entirely lost the senses of taste and smell. As she grew to girlhood she evinced a strong mind, but oh! in what silence and darkness was she enveloped! In 1837, Dr. Howe took her to his Asylum in Boston and successfully attempted the development of her intellect, at the age of eight years. The first attempt was to give her a knowledge of arbitrary signs, by which she could interchange thoughts with others. Then she learned to read embossed letters by the touch, next embossed words were attached to different articles, and she learned to associate

each word with its corresponding object. Her touch grew in accuracy as its power increased and she learned to know people almost instantly by the touch alone. In a few years, she was able to receive lessons in geography, algebra, and history. Her acquirements are indeed wonderful. She seems to live in an atmosphere of exquisite enjoyment. She is now a teacher of the blind and deaf and dumb, and is conferring on them the blessings she has herself received.

S. B. KECKLER.

919. How was the Greely Expedition gotten up, and for what purpose? What discoveries were made? R.

ANS.—The loss of the illfated *Jeannette* only stimulated scientific research, and daring explorers were ready to continue the search for the North Pole. Gen. Hazen of the U. S. Signal Service took a great interest in Arctic research, and when it was proposed to establish international polar stations, he induced Congress in 1880 to make appropriations for an expedition to establish permanent stations, by which the Pole might be reached by gradual approaches. The orders to Lieu. Adolphus W. Greely were, that he should make researches in Meteorology, Magnetism, the Aurora and Astronomy, exploring as large an area as possible. There were 24 officers on this expedition which started at St. Johns, N. F. July 7, 1881, and reached Disco Island at Good-haven two weeks later.

PHEBE SHIVES.

List of Contributors to this Number.

- B. F. FINKEL, *North Lewisburg, Ohio*, 897-8, 901-2-3.
 H. G. THOMAS, *German, Ohio*, 893-9, 901-2-3-4-13-18.
 T. L. BREWER, *Mt. Heron, Ohio*, 893-5-6-7-9, 901-12.
 ALBERT DAVISON, *West Newton, Ohio*, 893-4-5-6, 902-3-5-6-9.
 FOREST BALES, *N. Lewisburg O.*, 893, 900-1-2-5-9.
 J. D. BEARD, *Pymont, Ohio*, 893-4-9, 902-12.
 PHEBE SHIVES, *Woodington, Ohio*, 893-6-9, 901-5-8-12-13-14-18.
 J. H. W. SCHMIDT, *Ansonia, Ohio*, 893-5-6-9, 901-2.
 JACOB L. REPP, " " 893-5, 918.
 ED. RYNEARSON, *Gettysburg, Ohio*, 893-4-5-6-8, 901-2-3-10-12-13.
 C. H. BIGLER, " " 893-4-5-6.
 CHARLES STOLTZ, " " 917.
 MYRTLE GEORGE, " " 902.
 C. A. SEHBRING, *N. Star, Ohio*, 893-5-6-9, 901-2-5-8-12-13.
 S. B. KECKLER, *Weavers, Ohio*, 893-5-6-9, 901-2-5-8-12-13.
 JNO. FITZGERALD, " " 893-5-7, 901-4-6-12-13.
 J. W. KECKLER, *Ada, Ohio*, 893-905.
 GEO. L. SHANER, *Stewarts Station, Pa.*, 893-5-902-4-5-17.
 S. J. BROWN, *Blanchester, Ohio*, 893-4-5-8-9, 901-2-5-6-13-14.
 A. F. PRAGEL, *Versailles, Ohio*, 893-5-6, 901-2-4-8-10-12-18.
 D. W. K. MARTIN, " " 894-5-6-7-8-9, 900-1-2-3-4-10-12-18.
 B. D. LECKLIDER, *Greenville, Ohio*, 893.
 S. A. & H. L. LOTT, " " 895-6-9, 901-2-4-5-13-14-17-18.
 CHARLES W. BRUMBAUGH, *Baker, Ohio*, 895.
 HOWARD WOODS, " " 892-4-9, 902-12.
 HATTIE HARPER, *Horatio, Ohio*, 889, 903.
 CLARA BURKE, *West Sonora, Ohio*, 901-2-18.
 JOHN E. MURPHY, " " 883, 913-47.
 LAWRENCE DUNLAP, *Zanesfield, Ohio*, 901.
 M. W. HOLLINGER, *Hill Grove, Ohio*, 901-5-10-12.
 H. A. WOOD, Prof. of Physics, Case School of Applied Science, *Cleveland, O.*
 DR. FRANCIS N. THORPE, Fellow of History, University of Pa., *Philadelphia.*
- Querists.—B. S. DAVIS, *Gordon, Ohio*; L. M. ORLADY, *McConnellsville, Pa.*; JUEIUS A. SHEETS, *Calvary, Pa.*; L. A. MATHIAS, M. D., *Logan, Ohio*; CHAS. H. BIGLER, *Gettysburg, Ohio*; and others whose initials are taken from above list.

QUERIES.

943. What portion of country is known as the *Pan Handle*?
D. W. K.
944. What is meant by *The Triple Alliance*, *The Underground Railroad*?
Id.
945. Give a brief account of Leonard Calvert's company of catholics and their voyage to the New World. Name the two vessels that carried them.
Id.
946. What is meant by the *Siege of Ninety-six*?
DARKE.
947. Who first contrived the method of printing?
Id.
948. Has the earth ever passed through the tails of comets?
Id.
949. What is meant by the term *Bloody Bridge*?
Id.
950. What was the Massacre of the Glencoe?
C. W. B.
951. Over how many degrees of latitude does the sun cast vertical rays at any one time.
C. H. B.
952. What state refrained from voting for Lee's famous resolutions? Why?
S.
953. What causes equinoctial storms?
L. M. O.
954. Why is Persia called the *Peacock Throne* and a certain president the *Cincinnatus of the West*?
Id.
955. Give an account of the reverse of the great seal of the U. S.
Id.
956. What is the latest supposed formation of a meteor?
Id.
957. What was the *Astrolabe* used by Columbus?
G. L. S.
958. Who is the author of
"Wisdom and justice many men admire;
Jarring vice harms truth's pure, trembling fire;
Pray be loyal, just; go! highest good acquire."
L. A. M.
959. "If, when fully charged with vapor, the air is suddenly cooled, part of the vapor is thrown off."—*Appleton's Geography*. How does the air become suddenly cooled?
J. A. S.
960. Can the President and Vice President be elected from the same state? Explain.
C. A. S.
961. Give a history of the man who said, "Give me a place to stand and I will move the world."
J. D. BEARD.
962. Describe the *House-Tax Insurrection*.
A. F. P.
963. What was the *Bridge-Building Brotherhood*?
Id.
964. What were the last words of Henry Clay?
B. S. D.
965. What was the inscription on Mrs. A. Lincoln's wedding ring, and what became of it?
Id.

Answers should be received on or before June 5.



EDITED BY

JOHN S. ROYER.

VOL. VII.

JUNE, 1886.

No. 6.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

880. How many signals can be made with 3 blue and 2 white flags, which can be displayed either singly, or any number at a time one above another?

COOPER D. SCHMITT.

By B. F. FINKEL, N. Lewisburg, Ohio.

One, two or the 3 blue flags will make 1 signal; one or the 2 white flags will make 1 signal; 1 blue and 1 white flag can be arranged in $(2 \times 1) \div (1 \times 1) = 2$ different ways, and make 2 signals; 2 blue and 1 white make $(3 \times 2 \times 1) \div (2 \times 1 \times 1) = 3$ signals; 3 blue and 1 white make $(4 \times 3 \times 2 \times 1) \div (3 \times 2 \times 1 \times 1) = 4$ signals; 1 blue and 2 white make $(3 \times 2 \times 1) \div (1 \times 2 \times 1) = 3$ signals; 2 blue and 2 white make $(4 \times 3 \times 2 \times 1) \div (2 \times 1 \times 2 \times 1) = 6$ signals; 3 blue and 2 white make $(5 \times 4 \times 3 \times 2 \times 1) \div (3 \times 2 \times 1 \times 2 \times 1) = 10$ signals. Hence in all there are $1 + 1 + 2 + 3 + 4 + 3 + 6 + 10 = 30$ signals, which is the same result as Wentworth's Algebra gives.

NOTE.—If 2 blue or 2 white, or 3 blue flags were each used for signals, then three more signals could be given. Mr. Finkel wrote the combinations thus:

$$\frac{5!}{3!2!} = \frac{5 \times 4 \times 3 \times 2 \times 1}{(3 \times 2 \times 1)(2 \times 1)} = 10 \text{ signals.}$$

But the composition being troublesome, we simplified the operations. Read the first fraction thus: Factorial 5, divided by factorial 3 times factorial 2.

881. If we saw through $\frac{1}{4}$ of the diameter of a round log, what portion of the cut is made?

GEO. L. SHANER.

By HENRY GUNDER, New Castle, Ind.

The saw has cut $\frac{1}{4}$ the circumference and $\frac{1}{4}$ the diameter, the area of this segment is $\frac{1}{4}\pi - \frac{1}{4}\sqrt{3}$, radius 1. But the area of the whole log is π . Therefore the part cut is $\frac{1}{4} - \sqrt{3} \div 4\pi = 0.196 + < \frac{1}{5}$.

By D. W. K. MARTIN, Versailles, Ohio.

Represent the diameter of the log by 4. Then $OD = 2$, the radius, and $LK = 1$; hence $CD = 2\sqrt{(2^2 - 1^2)} = 2\sqrt{3}$. Because OD is twice OK , the angle COD is 120° , and the sector $OCLD$ is $\frac{1}{3}$ of the circle. The area of the segment CLD equals sector $OCLD$ — triangle OCD . Area of sector is $\frac{1}{3}\pi \times 2^2 = 1\frac{1}{3}\pi$, and area of triangle OCD is $(2\sqrt{3} \times 1) \div 2 = \sqrt{3}$; therefore, area of segment is $1\frac{1}{3}\pi - \sqrt{3} = 2.4567$. Area of circle is $2^2 \times \pi = 12.5663$; then we have $2.4567 \div 12.5663 = .1955$ part required.



The diagram for this solution is not quite true to scale, but you can easily imagine K to be equidistant from O and L . It was used for another problem.

882. According to formulæ tabulated for the U. S. Coast and Geodetic Survey, the magnetic declination at Portland, Me., (Lat. $43^\circ 38.8'$, Long. $70^\circ 16.6'$) is $13^\circ 16'$ west, and at Sitka (Lat. $57^\circ 2.9'$, Long. $135^\circ 19.7'$) the declination is $28^\circ 32'$ east. What is the absolute difference of direction of the magnetic needles at these places, each needle supposed horizontal?

PROF. COLMAN BANCROFT, Hiram, Ohio.

By HENRY GUNDER, New Castle Ind.

Let A be the pole of the earth and A' the magnetic pole. Let B be Portland and C , Sitka. Then we have two spherical triangles ABC and $A'B'C'$. In the first we have $c = \text{co-latitude Portland} = 46^\circ 21.2'$; $b = \text{co-latitude Sitka} = 32^\circ 57.1'$; and the angle A is the difference of longitude, or $65^\circ 3.1'$. From these parts we find angle $B = 47^\circ 42'$, angle $C = 79^\circ 42'$, and side $a = 41^\circ 49'$. From B and C subtract the magnetic declination at Portland and Sitka, respectively, and we have, $B' = 34^\circ 26'$; $C' = 51^\circ 10'$. Having the two angles B' and C' and the side a , as above, we easily find $A' = 79^\circ 6' 39''$, which is the required difference.

The above solutions are made by Chauvenet's *Spherical Trigonometry*, p. 183, eq. (126) and (127), and p. 186, formulas (m) , (m') and (134).

883. Do you consider the 13th example, page 367, *Ray's New Higher Arithmetic*, a fair question? Please solve.

S. R. WILLIAMS, Anna, Ohio.

PROB.—How many stakes can be driven upon a space 15 ft. square, allowing no two to be nearer than $1\frac{1}{2}$ ft.? $1\frac{1}{4}$ ft.? *Ans.*, 128; 180. Solution, p. 52. Vol. 2, *School Visitor*. All of Ray's difficult problems are solved in *Visitor*.

By B. F. FINKEL, North Lewisburg, Ohio.

Place 11 stakes on base line. By square arrangement we can place 11×11 or 121 stakes on the square. But if we place over these perpendicularly, as vertices of equilateral triangles, 10 others there will

be alternately 11 then 10 and so on. It is clear there will be no gain by this arrangement unless we can gain a row. The height of one of these triangles is $\sqrt{[(1\frac{1}{2})^2 - (\frac{1}{3})^2]} = 1.29903 +$ hence we gain $1.5 - 1.29903 + = .20097$ ft. in 1 strip. But we want to gain 1 strip or $1\frac{1}{2}$ feet in length of square, which will allow another row of stakes; $\therefore$ we have the proportion $.20097 \text{ ft.} : 1\frac{1}{2} \text{ ft.} :: 1 : 7+$. Then we gain one strip in 7 strips or there will be 8 strips on which make 9 rows of stakes, 5 of 11 stakes or 55 stakes, and 4 of 10 or 40. In the remaining 3 strips there will be no gain by this arrangement, by the square arrangement we can place 3 rows of 11 in a row or 33 stakes. In all $55+40+33=128$ stakes, *Ans.*

2d. By square arrangement we can place 13×13 or 169 stakes on the square, by triangular arrangement we can make 5 rows of 13 stakes or 65 stakes, in all 178 stakes. But try to have 15 rows instead of 14. There will be 14 strips each $15 \div 14$ or $1\frac{5}{14}$ ft. wide. Making the rows reach alternately from left to right side, from right to left. we will need for 12 trees at least $11\frac{1}{2}$ spaces $15 \div 11\frac{1}{2}$ or $1\frac{10}{11}$ ft. wide. Taking half of this for base and $1\frac{5}{14}$ for perpendicular, we find the hypotenuse $= \sqrt{(\frac{2}{1}\frac{2}{1}\frac{5}{14} + \frac{2}{5}\frac{2}{5}\frac{5}{14})} = 1.25+$ which is more than the allowable distance. Hence there is a gain by this arrangement and place 15 times 12=180 stakes on the square, *Ans.*

I consider this a fair question. I have been a little tedious, perhaps, but it is for the benefit of an ex-principal of the Amanda school, who claims that the answer in the book is wrong.

884. A and B start from the same point and travel in the same direction. A travels 18 mi. a day, and after 9 days turns and travels back as far as B had traveled in 9 days, then turns again and overtakes B in $22\frac{1}{2}$ days after starting. How far does B travel in a day? *C. W. BIGLER, Gettysburg, Ohio.*

By G. W. LEAHY and A. M. SCRIPTURE.

A travels in $22\frac{1}{2}$ days as far as B does in $22\frac{1}{2} + 18 = 40\frac{1}{2}$ days. $\therefore$ A's rate is to B's as $40\frac{1}{2}$ to $22\frac{1}{2}$, or as 9 to 5, and B's rate is $\frac{5}{9}$ of $18 = 10$ mi. per day.

By JOHN F. FROBE, W. C. BINKLEY and T. L. BREWER.

A travels $18 \times 22\frac{1}{2} = 405$ mi., which would take B $22\frac{1}{2} + (2 \times 9) = 40\frac{1}{2}$ days. Hence $405 \div 40\frac{1}{2} = 10$ mi. is B's rate per day.

885. How long a period must intervene between conjunctions of all the known primary planets of the Solar System, and by what method of Elementary Arithmetic can the time be most easily computed?

N. B. WEBSTER, A. M., Yonkers, N. Y.

By J. W. PFEIFFER, *Bolivar, Ohio.*

Mercury revolves around the sun in $1\frac{35}{461}$ yr.; Venus, in $2\frac{69}{388}$ yr.; Earth, in 1 yr.; Mars, in $1\frac{2}{34}$ yr.; Jupiter, in 12 yr.; Saturn, in $29\frac{1}{2}$ yr.; Uranus, in $84\frac{3}{87}$ yr.; and Neptune, in $164\frac{1}{2}$ yr. The "Least Common Multiple" of these numbers, which is 88385702658640, is the time required in years.

886. Prove, when the sum of the hypotenuse and altitude of any right-angled triangle equals the square of the base, that their difference is unity.

MARCELLAS M. THOMPSON, *Clarksburg, W Va.*

By WM. WILEY and COOPER D. SCHMITT.

Let a be the altitude, b the base, and h the hypotenuse. $h^2 - a^2 = b^2$, and $h + a = b^2$; hence $h^2 - a^2 = h + a$, dividing by $h + a$, we have $h - a = 1$. Q. E. D.

887. Two trees are a certain distance apart; from the top of A to foot of B is 60 feet., from top B to foot A is 40 feet. From the point where these two lines intersect to the plane is 15 feet. What is the height of each tree and the distance apart?

B. F. FINKEL-

By A. L. FOOTE, *Merrick, N. Y.*

Let BC represent the taller of the trees, AD the shorter, AB the plane on which they stand, E the point of intersection of intersection of the lines from their tops, and $EF=15$, its distance from the plane. Then by similar triangles, we have the following proportions:

$$DE : AF :: DB : AB,$$

$$AE : AF :: AC : AB, \quad DE : AE :: BD : AC$$

And likewise, $CE : BE :: AC : BD$. But $AC : BD :: 3 : 2$.

Hence, $CE : BE :: 3 : 2$. Put $CE=3x$ and $BE=2x$; then will $DE=40-2x$ and $AE=60-3x$. Again we have

$$AE : EF :: AC : BC=300 \div (20-x);$$

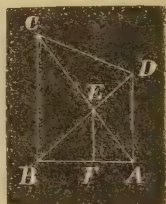
$$\text{Also} \quad BE : EF :: BD : AD = 300 \div x;$$

$$\text{and we have} \quad AC^2 - BC^2 = BD^2 - AD^2$$

or $60^2 - [300 \div (20-x)]^2 = 40^2 - (300 \div x)^2$, from which, after reduction, we have the equation $x^4 - 40x^3 + 400x^2 - 1800x = -18000$. By Horner's method we find $x=13.95412+$; hence $300 \div x=21.49902+$ feet, the shorter tree; $300 \div (20-x)=49.620568+$ ft. the taller; and we readily find $AB=33.7312+$ feet, the distance between them.

By D. H. DAVISON, *Minonk, Ill.*

In the figure above, put $AC=a=60$, $BD=b=40$, $EF=c=15$. Let $x=AF$ and $y=BF$, and $\sqrt{c^2+x^2}=AE$, and $\sqrt{c^2+y^2}=BE$.



By similar triangles $\sqrt{(c^2+x^2)} : x :: a : x+y \dots (1)$,

Also $\sqrt{(c^2+y^2)} : y :: b :: x+y \dots (2)$.

From (1) we have $(x+y)\sqrt{(c^2+x^2)} = ax \dots (3)$.

Squaring (3), etc., $y^2+2xy = a^2x^2 \div (c^2+x^2) - x^2 \dots (4)$, a complete

quadratic whence $y = x\{\sqrt{[a^2 \div (c^2+x^2)]} - 1\} \dots (5)$.

Put $m = \sqrt{[a^2 \div (c^2+x^2)]} - 1 \dots (6)$,

Then $m^2 = a^2 \div (c^2+x^2) - \sqrt{[4a^2 \div (c^2+x^2)]} + 1 \dots (7)$.

Also, from (6), $\sqrt{[a^2 \div (c^2+x^2)]} = m+1 \dots (8)$.

From (5), $y = xm \dots (9)$

From (2) we find $x = y\{\sqrt{[b^2 \div (c^2+y^2)]} - 1\} \dots (10)$.

Substitute value of y in (9) into (10), gives

$$x = xm\{\sqrt{[b^2 \div (c^2+x^2m^2)]} - 1\} \dots (11).$$

Dividing (11) by x , $1 = \sqrt{[m^2b^2 \div (c^2+x^2m^2)]} - m \dots (12)$,

Whence $\sqrt{[m^2b^2 \div (c^2+x^2m^2)]} = m+1 \dots (13)$.

Equating values of $m+1$ in (8) and (13) gives

$$\sqrt{[m^2b^2 \div (c^2+x^2m^2)]} = \sqrt{[a^2 \div (c^2+x^2)]} \dots (14).$$

Squaring & clearing $m^3 = a^2c^2 \div [b^2c^2 - (a^2 - b^2)x^2] \dots (15)$.

Equating values of m^2 in (7) and (15), and transpose terms, give

$$\sqrt{[4a^2 \div (c^2+x^2)]} + a^2c^2 \div [b^2c^2 - (a^2 - b^2)x^2] - a^2 \div (c^2+x^2) = 1,$$

From which, by position, we find $x^2 = 103.97303$; $\therefore x = 10.196716$.

By substitution, $y = 23.53446$; $x+y = 33.731176$ feet, trees are apart.

Now, having the base and hypotenuse, we find the taller tree to be 49.62063 ft. high and the shorter tree, 21.49901 ft.

888. A man on the bank of a river desires to know the distance to an object on the other side of the stream; how can he find the distance, providing he has nothing but a ten-foot pole? D. W. K. MARTIN, *Versailles, Ohio*.

By D. H. DAVISON, *Minonk, Ill.*

Let P be the object across the river, and A the point on the bank. Measure 8 feet from A back to a point B which is in line with A and P . Turn a right angle from B 6 feet to C . Also from A set D 6 ft. from A at right angles from line BP ; forming the rectangle $ABCD$ whose diagonals AC and BD are each 10 feet. Let E in line with PD and BC , measure EC . Then from similar triangles we have $EC : CD :: DA : AP$, the distance required.

889. "If I pay \$1500 for 2 years rent, and \$100 for repairs, how much rent payable quarterly is that equal to, alloting 8% interest? W. C. BINKLEY.

By D. W. K. MARTIN, *Versailles, Ohio*.

$\$1500 + \$100 = \$1600$, present value of payments at 2%. Present

value of an immediate perpetuity of a payment at $2\% = \$1 \div .02 = \50 ; and present value of such a perpetuity deferred 8 intervals or quarters at $2\% = \$50 \div 1.171659$ the compound amount of \$1 for 8 quarters at $2\% = \$42.674$. Then the present value of an annuity of \$1 $= \$50 - \$42.674 = \$7.325$, and $\$1600 \div 7.325 = \218.415 per quarter $= \$873.66$ a year.

890. Required the best solution by quadratics of the following:

$$(1) x^3 + y^3 = a \quad (2) x^2 + y^2 = b. \quad \text{J. K. ELLWOOD.}$$

By J. W. PFEIFFER, *Bolivar, Ohio.*

Let $x+y=S$, $xy=P$, $a=35$, and $b=13$; then $(1)=S^3-3PS=35$; and $(2)=S^2-2P=13$; hence $(S^3-35) \div 3S = (S^2-13) \div 2$; or $S^3-39S=-70$. Multiplying by S and adding $49S^2+25$ to both sides and extracting square root, $S^2+5=\pm(7S-5)$; from this, we find $S=5$, and $P=6$; hence $x=3$, and $y=2$. Whenever, in a cubic equation of the form $x^3+ax=b$, b can be divided into two factors m and n , so that $m^2+a=n$, then the cubic equation can be resolved as a quadratic. $S^3-39S=-70$ is an equation of this form, and the equations $x^3+y^3=a$, and $x^2+y^2=b$ will always reduce to this form.

By A. L. FOOTE, *Merrick, N. Y.*

Let $x+y=s$ and $xy=p$; then from (1) we have $s^3-3ps=a$. . . (3), and from (2), $s^2-2p=b$. . . (4). Equating value of p in (3) and (4), we find $(s^3-a) \div 3s = \frac{1}{2}(s^2-b)$. . . (5); or thus, $s^3-3bs=-2a$. . . (6). To render this quadratic, let $s=b \div z+z$, and we have, by substitution in (6), $z^6+2az^2=-b^3$. . . (7). Solving, $z^3=-a \pm \sqrt{(a^2-b^3)}$, or $z=\sqrt[3]{\sqrt{(a^2-b^3)}-a}$; from which, having the numerical values of a and b , we know the value of z , from which s becomes known, and finally x and y , by purely quadratic formulæ.

891. Fill a nine square with square numbers such that the sum of the numbers in the large square and each smaller square shall be square numbers.

J. C. ROEBUCK, *Rockfalls, Iowa.*

By A. L. FOOTE, *Merrick, N. Y.*

Take the series $[x-(n-1)]^2$, $[x-(n-2)]^2$, $[x-(n-3)]^2$ x^2 . . . $[x+(n-3)]^2$, $[x+(n-2)]^2$, $[x+(n-1)]^2$. If we begin with the center the sum of one term $=x^2$, of three terms $=3x^2+2$, of five terms $=5x^2+10$, of seven terms $=7x^2+28$, of nine terms $=9x^2+60$, and of $2n-1$ terms $=(2n-1)x^2+\frac{1}{3}(2n^3-3n^2+n)=S$; now if we take $n=5$ we have $9x^2+60=\square$ which will be the case when $x=\pm\frac{2}{3}$. Now put $x=y-\frac{2}{3}$ and substituting we have $9y^2-12y+64=\square$ which is true

when $12y=64$ or $y=\frac{16}{3}$ and consequently $x=\frac{14}{3}$. So to find the consecutive roots we need simply to multiply $\frac{2}{3}, 1\frac{2}{3}, 2\frac{2}{3}, 3\frac{2}{3}, 4\frac{2}{3}, 5\frac{2}{3}, 6\frac{2}{3}, 7\frac{2}{3}$ and $8\frac{2}{3}$, by 3, and we have 2, 5, 8, 11, 14, 17, 20, 23, 26, whose squares $4+25+64+121+196+289+400+529+676=2304=(48)^2$ as required.

List of Contributors to this Number.

G. W. LEAHY, *Marshallville, Ohio*, 884-6.
 J. E. GENSEMER, *Marshallville, Ohio*, 881-4.
 WM. KAUFFMAN, *Marshallville, Ohio*, 880-1-4-6.
 W. C. BINKLEY, *Cincinnati, Ohio*, 880-1-3-4-6-8-9.
 B. F. FINKEL, *North Lewisburg, Ohio*, 880-1-3-4-8-9.
 J. W. PFEIFFER, *Bolivar, Ohio*, 880-1-3-4-5-6-7-8-9-90.
 HENRY GUNDER, *New Castle, Ind.*, 880-1-2-6-7-8-90.
 A. L. FOOTE, *Merrick, N. Y.*, 881-3-4-6-7-8-9-90-1.
 D. S. POND, *Rochester, Ohio*, 881.
 GEO. L. SHANER, *Stewart Station, Pa.*, 881.
 D. W. K. MARTIN, *Versailles, Ohio*, 881-3-4-6-9.
 D. H. DAVISON, *Minonk, Ill.*, 881-4-6-7-8-9.
 R. A. LEISY, *Burton City, Ohio*, 881-3-4-5-6-8-9.
 T. L. BREWER, *Mt. Heron, Ohio*, 881-3-4-8.
 A. M. SCRIPTURE, *Clinton, N. Y.*, 881-4-6-7.
 WM. WILEY, *Detroit, Mich.*, 881-2-4-6-7-
 COOPER D. SCHMIDT, *Woodstock, Va.*, 881-4-6-90.
 JOHN F. FROBE, *Versailles, Ohio*, 881-4-7.

Problems for Solution.

904. The frustum of a cone, bases r_1 and r_2 , length l , is twisted by a couple whose moment is M ; required the total angle of twist.

DE VOLSON WOOD, *Hoboken N. J.*

905. I have a uniformly tapering log, the sum of the diameters of whose ends is 4 feet; and if the difference of the diameters of the ends be subtracted from its length the remainder is 24 ft. Now, admitting the center of gravity of the log to be 17 feet from the small end, tell the diameters of the ends and length of the log.

A. L. FOOTE.

906. Two men killed a deer. Wishing to divide it equally and having no convenient way of weighing it, they procured a pole, and placed it over a limb, and A who weighed 120 lb. balanced B who weighed 130. Then A taking the deer exchanged places with B, and B balanced A and the deer; what is the weight of the deer? Simple solution.

B. F. FINKEL.

907. Given $(x^6+1)=(y^2+1)x^3 \dots (1)$ and $(y^6+1)x=9(x^2+1)y^3 \dots (2)$, to find x and y .

G. A. STINE, *Lindsey, Ohio*.

908. If 4 liters of water and 1 liter of sulphuric acid, specific gravity 1.842, when mixed shrink $\frac{1}{4}$ of 1%, what is the specific gravity of the mixture?

I. B. SANDERS, *Cambridge City, Ind.*

909. A pays B \$230 as the present value of \$300 due in 5 years. Which gains by the payment, and how much, if interest is reckoned at 5%? *Id.*

910. At each angle of a triangle, being on a level plain and having sides respectively 40, 50 and 60 feet, stands a tower whose height equals the sum of the two sides including the angle. Required the length of a ladder to reach the top of each tower without moving its foot.

D. H. DAVISON.

Solutions should be received on or before July 10.

Biographical Sketches of Contributors.

D. S. POND, *Rochester, Ohio*, is an esteemed friend of the *Visitor*. He is 81 years old, and enjoys gardening and mathematical investigations as pastime recreations. He left school at 19 with a fair knowledge of Adam's Arithmetic, but while clearing the primeval forest and laboring as a mechanic, he mastered all the elementary branches of the science, and we find him original and practical in all his work.

S. J. BROWN, *Blanchester, Ohio*, was born July 12, 1859. He was reared on a farm near his present home, working on it in summer time and going to school at Blanchester in the winter. He commenced teaching in 1880 and intends to continue in the work. He is now at Lebanon Normal School. He writes out his contributions to our magazine in a very neat and concise manner.

ALBERT DAVIDSON has been conducting the West Newton (Ohio) school for three years with marked success. His favorite study is mathematics, and he has been one of the *Visitor's* devoted friends, having every number issued. He began teaching at 19, having prepared himself by attending the Normal schools at Ada and Valparaiso (Ind.). He was 25 years old on the 30th of last January.

SIMON BEERY KECKLER, *Weavers, Ohio*, was born in Fairfield county, Ohio, May 29, 1860, and came with his parents to this county a year later. He grew up on the farm, attending a country school 3 or 4 months in a year. In the spring of '81 he went to school at Lebanon, and commenced his first school on the day of Garfield's death. Married Susan Mote March 21, 1882, and has been teaching and farming since. He became a subscriber to this magazine in 1881, to which he ascribes much of his progress in education since leaving school. He is among the wide-awake and active teachers in the county.

GEORGE G. BROWER is of Scotch descent and 25 years old. His parents died before his ninth year, and until his 19th, he worked on the farm. He attended the Whitestown (N. Y.) Seminary, and the Hungerford Collegiate Institute at Adams, N. Y., where he graduated in 1882. He has since spent two years in the Syracuse University, and expects to graduate from this college after one more year's work. He taught in the Union School at Lee Center last winter, and his permanent address is Taberg, N. Y. He is a lover of Mathematics and the Natural Sciences, and will rise to distinction in that direction. He does thorough work, both as teacher and student.

J. W. PFEIFFER was born in Prussia, 1849. When but four years old his parents immigrated to Ohio, and settled on a farm in Tuscarawas Co., where Mr. Pfeiffer spent his early life, attending district school during the winter. He attended a German grammar school, the Dover Union Schools and lastly three years in the McNeely Normal under the late Prof. Wm. Brinkerhoff. Here he excelled in history and mathematics. Conic sections and the Calculus, however, he studied without the aid of a teacher. The first two years of his teaching he spent at Zoar. For seven years since, he has been Principal of the Bolivar schools, and will continue his work there. In the mean time he had charge of a Central High School of an adjoining township. We find Mr. Pfeiffer a thorough scholar, characteristic of his nationality, and as a teacher he is hard to excel. He raised a large club to the *Visitor* this year, which is appreciated.

W. C. BINKLEY is a self-made scholar, his entire attendance at school being about twelve months. He was born near Blanchester, Ohio, July 14 1856, and worked on the farm and sawmill till 1874, when he embraced the opportunity of attending a district school in Clinton Co., taught by W. J. Sewell, now school examiner of that county, who was so highly pleased with Mr. Binkley's progress, that he persuaded him to teach. He commenced teaching in 1876, and continued till 1883, when curiosity prompted him to try the Civil Service examination at Cincinnati for clerkship in that post-office. He passed with success, and received his appointment July 24, 1883. He has held successively the position of "distributing clerk," "cancelling clerk" and "nixie clerk." We admire his pluck and feel thankful for the interest he has taken the *Visitor*. He commenced reading the *Visitor* with Vol. 1, No. 11, and has every number from that date. He says that it stimulated him "to search for knowledge."

J. K. ELLWOOD was born in Westmoreland Co., Pa., in 1858, where he spent his minority on a farm. At 21 he went to Thiel College, but left in less than a year, for Heidelberg College, Tiffin, Ohio, where he graduated with highest honors in 1883. During his Junior year, he was Tutor in Mathematics. After graduation he was made Principal of Saltsburg (Pa.) Academy, but he soon resigned to take charge of St. Petersburg Normal and Classical Institute. In 1885 he was chosen director of the State Teachers' Reading Circle, and later resigned to accept the superintendency of the public schools at Mauch Chunk, Pa., pop. 5,000, and a great summer resort. It is said 100,000 visited that little "Switzerland of America" last season. Mr. Ellwood is wonderfully energetic and possesses a high degree of executive ability, which eminently fit him for his present position.

C. W. THOMPSON, now principal of the Martin School, Kansas City, Mo., was born in New Orleans, Feb. 6, 1848. He went with his parents to southern Mexico in 1850, and to Cincinnati in 1855, where he entered the 9th street public school without knowing scarcely a word of English, being Spanish. From 1865 to 1870, he was dissipated and finally landed in Jackson Co., Mo., bankrupt in more ways than one. Then and there was the pivotal period of his life. With noble resolves he determined to tread the paths of rectitude and of pleasantness, and forever abandon the maelstrom of vice. Here he wooed and won, and settled down to the quiet uneventful life of a farmer. In 1875 he met with an accident which cost him his right foot, and during four years confinement to his bed, he devoted himself so persistently to his books, that in '79 he was pronounced qualified to teach. He has taught ever since with good success.

A. F. PARSONS was born at Huntsburgh, Ohio, May 21, 1855, and spent the first sixteen years on the farm. The very common schools of his time and place did not afford him the desired advantages, so he entered the class of '75 in Hiram College, under the presidency of B. A. Hinsdale, who is now superintendent of the Cleveland Schools. Mr. Parsons left before the Junior year on account of ill health, and in 1874 he went to Friendship, N. Y., where he attended Baxter's University of Music, receiving the degree of "Mus. B." in '75. Intervals between terms (after the age of 18) were spent in teaching, both common schools and music classes. He went to San Luis, Obispo Co., Cal., in 1876, and has been teaching ever since. At present he is principal of the Arroyo Grande Schools, besides teaching music, practicing surveying and civil engineering and farming a small tract of Arroyo Grande "Monte" land. His knowledge of mathematics has been self-acquired during odd hours and by the study of publications like the *Visitor*. He is an accurate and thorough worker, possessing a remarkable skill in solving difficult problems.

COOPER D. SCHMITT, of Woodstock, Va., was born where he now lives, Dec. 4, 1829. His ancestors came from Switzerland, though his father was born in Virginia. From 1865 to 1876 he attended the common school, studying algebra when only nine years old, and at twelve had worked through Davies Boudon. In 1876 he went to Mercersburg (Pa.) College, from which he graduated in 1879. He taught two years then entered the University of Virginia, graduating there in 1884 with the degree of M. A. He always stood first in his classes at college, and one year he obtained the highest marks in the institution. He is fond of athletic sports, and enjoys these in his association with pupils. For two years he has been Professor of Mathematics and Greek in the Pantops Academy, near Charlottesville, Va. His diploma in M. A. includes Latin, Greek, French, German, Chemistry, Nat. and Moral Philosophy. Besides this, he has acquired a fair knowledge of Hebrew. He is versed in the drug business and art of printing, and with such versatility of intellect, he will no doubt place his name high upon the scroll of fame and renown. He was married last year. He is left-handed in everything, even in writing, yet his manuscripts are remarkably neat and well written. We hope he may continue to contribute regularly.

JOSEPH CUSTER CORBIN, *Little Rock, Ark.*, was born March 26, 1833, at Chillicothe, Ohio. He was sent to school quite early, but when he became 10, he was put to steady work. His folks were poor, and being the oldest of eleven children, he had to help to support the little ones. At fifteen, he commenced teaching at Louisville, Ky. Here he determined to prepare for a college course and studied algebra and Latin. He went to the Ohio University, at Athens, in 1850, and graduated in 1853. Taught again in Louisville, then clerked in a bank and mercantile agency in Cincinnati. He married Miss Mary J. Ward and raised three children. After teaching in Missouri several years, he went to Arkansas in 1871. In this state he served successively as newspaper reporter of the *Arkansas Republican*, chief clerk in Little Rock post-office, state superintendent of public instruction, and for a late number of years as principal of Branch Normal College of Arkansas Industrial University, at Pine Bluff. He is a member of the Baptist Church, and has served as organist and S. S. superintendent for several years. The *Visitor* had the honor of his acquaintance from the beginning and enjoyed friendly relations ever since.

SILAS POWERS BARTLETT, *East Dixfield, Me.*, is a veteran among our mathematical friends, having completed his 69th year Feb. 3. In his day Maine afforded limited opportunities for schooling. We used to admire his mathematical work in the *School-Day Magazine*, and regarded him then, as now, a mathematician of more than ordinary ability. He acquired most of his knowledge in this line from correspondence with James Clark, who never went to school a day, ran away from his home in Scotland, and finally settled in Wayne, Me., where he died. It was he who introduced Dr. Bartlett to the mathematics in the *London Times*. He also corresponded with others, and solved the problems in *Maine Farmers Almanac*, *School-Day Visitor*, *London Times*, etc. In 1838 he commenced the study of medicine, graduated in 1841. He was the second of a family of seven children, and has three brothers and one sister living. His own family consists of two sons two daughters, in whom he is proud, and in whose affections his declining years will be made cheerful and happy. His youngest daughter, twenty years old, is now among the most successful and highly esteemed students of the Normal School at Farmington, Me. The *Visitor* goes to that place, perhaps through the good words of Miss Bartlett. Friends can aid the noble cause by recommending our magazine to those who should have it. Dr. Bartlett knows its value by experience and recommends it.

J. M. TAYLOR, Professor of the Science and Art of Teaching in the University of Wash. Ter., at Seattle, was born at Waterford, Ohio, June 3, 1854. His father was a boat-builder and carpenter, with whom he worked till he was seventeen, attending school several months in the year. In 1871, he entered the high school at Stockport, and the next two years at Malta. He completed Algebra, Geometry and Trigonometry in the high-school course, and in 1874 was admitted at Adrian (Mich.) College, but left next year for want of means. He now began to attend teachers' institutes, and received the lectures of Henkle, Harvey, Ogden, Hancock and other eminent Ohio teachers. He also procured books on teaching. In the mean time he pursued his mathematical studies, taking Artemas Martin's publications, and as soon as our *Visitor* entered the field, he subscribed and he treasures a complete set with great care. After teaching and working at the carpenter trade in Morgan county, Ohio, in April 1879, he emigrated to Milton, Oregon, where he followed the trade one year, then took charge of the public schools as principal, served as postmaster for years, and also taught elocution and book-keeping to night classes. In 1883 he became principal of the Centreville schools, next year of the Eastern Oregon State Normal School. Here he resigned in 1885 to accept the professor's chair in the University which he still holds. He lectures before institutes, and is doing a good work in his state. He was married twice and has three children. His skill in mathematics he attributes to periodicals on that subject, from which he draws inspiration. He says, "The *School Visitor* shall always find a place in my studio, because it is a store-house of knowledge and a source of great pleasure."

HENRY GUNDER was born at Arcanum, Ohio, Sept. 15, 1837. His early years were passed on the farm. In the country school houses of his native state he early manifested that thirst for knowledge which has ever distinguished him as the devotee of popular education. He availed himself of all the advantages offered by these schools, and afterwards requiring superior aliment, he devoured with avidity linguistic study and science, while in higher mathematics, the clarity in higher which every truth stood forth in demonstration, held him in fascination by the midnight lamp. *Excelsior* was the inspiration of his boy life, but his *Italia* was beyond the Alps; and height after height was attained, only with fresh enthusiasm to press onward and upward. Problems were solved in the solitude of country meadows, and fields of thought were explored under the silent stars. At length we find him as teacher in these country schools.

After six years, the ardent, scholarly, conscientious instructor emerges from obscurity and becomes Principal of the Germantown (Ohio) High School. But a larger field of labor awaits him, and in 1867, still young in years, he becomes Principal of the Greenville High School. For seven years he teaches with distinguished success, infusing into the minds of his pupils a determination and will power that enabled them to grasp and conquer difficulties; thus fostering that intellectual development vastly superior to the vague knowledge gained from text-books, which so many students fail to carry beyond the class room. *Vincit Animus* was the watch word; and from intellectual power gained there followed high hours of conquest. Two pupils, boys in their teens, Edwin Lindsay Matchett and Charles Lindemuth, took the West Point course in mathematics under Mr. Gunder's tuition, and so thorough had been the instruction, that immediately after graduation they entered Cornell University. Examinations, passed with marked ability including Latin and Greek, admitted these students to the classical course of an institution equal in standard of scholarship to Harvard or Yale. No more fitting commentary on the character of Mr. Gunder's teaching can be expressed than the elevating influence of those who were imbued with high ideals of life in its varied relations, from the inspiration of the school room. "We study facts not books," was the remark of one of his school boys who now turns the pages of immortality. And yet books held their appropriate place, but the student was led to think and examine for himself, thus developing his own individuality. Life with its grand possibilities was presented by this faithful teacher as a chain of links, where progress and character building make the harmony complete.

In Mr. Gunder's stay here, he received a life certificate from the state examining board. In 1875 Mr. Gunder became Supt. of the public schools of North Manchester, Ind. Success again crowns his labors for he develops talent for his work by organizing one of the best systems of schools in northern Indiana. After five years of active efficient labor, we follow Mr. Gunder to New Castle in the same state, where again serving as Sup't of the public schools for two years, he retires after an experience of twenty years, from the profession of teaching. Thus in this pleasant retrospect as we look down the long vista, tracing the footsteps of the enthusiastic school boy from the threshold of his first log school house as it were, to the honored positions he has since occupied we feel that it is not for *eulogy* to crown one whose life has already gathered the laurels.

On Arbor Day of the present year, there was planted on our school grounds a tree that will lend its silent beauty to perpetuate the memory of one who shall live in our affections. More recently Mr. Gunder has given much of his time to higher kinds of Biblical criticism. Socially, it is not only a pleasure but a privilege to know Mr. Gunder, his cultivated mind and habits of profound thought making him a most interesting acquaintance. A quiet retiring manner and disposition has kept the subject of this sketch far from the footlights of public adulation, but the majestic oak, growing in the grandeur of its strength, by the very process of growth, towers in the sunlight above the gloaming.

MRS. W. H. MATCHETT, Greenville, Ohio.

We could not publish all Mrs. Matchett furnished for want of space.

Examination Questions.

Used at Greenville, Ohio, Saturday, June 5. Next examination is to be held July 3. Tell your friends to subscribe for the *Visitor*.

GEOGRAPHY.

1. What and where is the Llano Estacado, Llanos, Selvas of the Amazon, Pampas, and the Everglades?

ANS.—*Llanos Estacado* is a staked plain in Western Texas. *Llanos*, grassy plains of the Orinoco. *Selvas*, forests in Brazil. *Pampas*, grassy plains of the Rio de La Plata. *Everglades*, shallow lake in southern Florida.

2. Explain why the days and nights are each six months long at the poles and twelve hours at the equator.

ANS.—Because the circle of illumination embraces one pole and excludes the other, owing to the obliquity of the earth's axis, for six months; but at the equator the days and nights are always equal.

3. Locate the following islands: Formosa, Southampton, Luzon, Trinidad, and the Isle of Man.

ANS.—*Formosa*, in China Sea. *Southampton*, in Hudson Bay. *Luzon*, one of the Philippine Islands. *Trinidad*, north of S. America. *Isle of man*, in Irish Sea.

4. Into what do the following rivers empty: Indus, Ganges, Tarim, Orinoco and Yukon?

ANS.—Arabian Sea, Bay of Bengal, Lake Lop, the Atlantic and Behring Sea, respectively.

5. What waters are connected by the following straits: Babel Mandeb, Bosphorus, Dover, Belle Isle, and Davis?

ANS.—Red Sea and Indian Ocean, Sea of Marmora and Black Sea, English Channel and North Sea, Gulf of St. Lawrence and the Atlantic, Baffin's Bay and the Atlantic, respectively.

6. Locate the following capes: Charles, Barrow, Sable, Hatteras, San Lucas, St. Roque, Land's End, Comorin, Lopatka, Romania.

ANS.—Va., Alaska, Nova Scotia and Fla., N. C., L. Cal., S. Amer., England, India, Kamtchatka, Malay Pen., respectively.

7. What are the equinoxes?

ANS.—Times when the sun is over the equator or equal days and nights.

8. Name and account for a rainless district.

ANS.—Desert of Atacama, caused by the height of the Andes intercepting the moisture of clouds that come from the Atlantic.

9. Name ten important seaports.

ANS.—New York, Charleston, San Francisco, Liverpool, Havre, Alexandria, Singapore, Yokohama, Canton, Sydney.

10. Name the chief exports and imports of the United States.

ANS.—Exports, breadstuffs, cotton, petroleum, tobacco, live stock, and manufactured articles. Imports, silks, manufactured articles, tea, coffee, etc.

SPELLING.

Admission, contemn, Louisiana, Missouri, Dakota, Arkansas, quorum legally, jurisdiction, tiny, lily, limn, liquefy, teutonic, scythe, scholastic, riparian, rinse, pitted, meliorate.

ARITHMETIC.

1. If stock bought at 15% premium pays 7% on the investment, what would it pay if bought at 10% discount?

ANS.—The stock costs 115% and pays $115 \times .07 = 8.05\%$ on the par value; but if bought at 90% of the par value, it would pay $8.05 \times 100 \div 90 = 8\frac{1}{2}\%$.

2. A grocer marked tea at 90 cents per pound; if he could fall 15% from the marked price and yet gain 10% on cost, find cost per lb.

ANS.—He would sell for $90 \times .85 = 76\frac{1}{2}$ cents; cost was $76\frac{1}{2} \div 1.10 = 69\frac{6}{11}$ cents.

3. What is the surface of the largest cube that can be made from a sphere which contains 14137.2 cubic feet?

ANS.—The diameter of the globe is $\sqrt[3]{(14137.2 \div .5236)} = 30$ feet, which is also the diagonal of the required cube; hence its surface is $30^2 \div 3 \times 6 = 1800$ sq. ft.

4. I sold an article at 20% gain; had it cost me \$300 more, I would have lost 20%. Find the cost.

ANS.—Let 100% represent the original cost; then I receive 120%. By the second condition the cost is $100\% + \$300$, and I receive 80% of $(100\% + \$300) = 80\% + \240 ; but I receive the same price in each case, and $120 - 80$, or 40% must be \$240; hence $240 \div .40 = \$600$ is the cost.

5. Two boys were flying a kite. The string was 720 ft. long. One boy who stood directly under the kite, was 56 ft. from the other boy who held the string. How high was the kite?

ANS.—The height required is the hypotenuse of a right-angled triangle, whose hypotenuse is 720 feet and base 56 feet, which is $\sqrt{(720^2 - 56^2)} = 717.8$ feet.

6. A log 1 ft. 6 in. thick, is sawed into 11 boards, each 1½ in. thick. What per cent is wasted?

ANS.—The loss in saw-kerf is $18 - (11 \times 1\frac{1}{2}) = 4\frac{1}{2}$; $\therefore 4\frac{1}{2} \times 100 \div 18 = 23\frac{1}{3}\%$.

7. How many pounds of wheat in a cylindrical sack whose diameter is 1½ feet, and whose length is 1¼ yards?

ANS.—The diameter of sack is 18 inches and length 63 inches, and since one pound of wheat contains $2150.4 \div 60 = 35.84$ cu. in., we have $18^2 \times .7854 \times 63 \div 35.84 = 447.31$ pounds.

8. Six men can do a piece of work in $4\frac{1}{3}$ days; after working two days, how many men must join them to complete it in $3\frac{2}{3}$ days?

ANS.—It would require one man $6 \times 4\frac{1}{3} = 26$ days; in 2 days 6 men do $2 \times 6 = 12$ days work, and $26 - 12 = 14$ days work remains to be done in $3\frac{2}{3} - 2 = 1\frac{2}{3}$ days, which requires $14 \div 1\frac{2}{3} = 10$ men; hence $10 - 6 = 4$ men must join them.

9. A pole, the length of which is 78 feet, is in the air and water; $\frac{2}{3}$ of the length in the air, plus 12 feet, equals $1\frac{1}{2}$ times the length in the water. What is the length of each part?

ANS.—The length in the water is $\frac{2}{3}$ of the length in air, + 8 feet, to which add the length in air, and we have $1\frac{1}{2}$ of the length in air, + 8 feet, to equal the length of pole, or 78 feet; hence $(78 - 8) \div 1\frac{1}{2} = 40$ feet is the length in air, and $78 - 40 = 38$ feet, length in water.

10. Together A and B can eat 100 apples in a week. A can eat 10 more than B and 20 more than C. What is the least number of apples that would last them each separately and altogether, an exact number of weeks?

ANS.—B eats $(100 - 10) \div 2 = 45$ in a week, A $45 + 10 = 55$, and C $55 - 20 = 35$, and all together 135; hence the L. C. M. of 35, 45, 55 and 135, which is 10395 is the number of apples. When they eat together it will take 77 weeks; separately, A 189 weeks, B 231 weeks, and C 297 weeks.

HISTORY.

1. Name ten American generals and state in what war each was engaged.

Ans.—Washington, Gates, and Greene of the Revolution; Perry and Jackson of 1812; Scott and Taylor of the Mexican; and Grant, Sherman and Sheridan of the Civil War.

2. Sketch Gen. Grant's military career. His political career.

Ans.—*Military*—Graduate of West Point, 1843; Lieutenant in Mexican War, 1847; Captain in 1853; Colonel, brigadier-general, major-general, and commander-in-chief, successively, in the Civil War. *Political*—Sec'y of War, 1857; President of the U. S. 1869-77.

3. What were the Alabama Claims? How settled?

Ans.—Demands on the part of the U. S. for damages incurred from a violation of English neutrality in the Civil War, by the cruises *Alabama*, *Florida* and the *Shenandoah*. See *Visitor*, Vol. 5, p. 195.

4. What Vice-Presidents held the office of President. State how each was placed in office?

Ans.—Tyler, Fillmore, Johnson and Arthur, by the death of the President.

5. Give an account of St. Clair's defeat. When and where did it happen?

Ans.—In the Indian War, Gen. St. Clair marched into the N. W. Territory with 2,300 men, was surprised by a large force of Indians under "Little Turtle" and severely beaten, Nov. 4, 1791, near what is now Ft. Recovery, Ohio. The rout continued through this county 25 miles to Ft. Jefferson.

6. Which state is entitled to the most representatives in Congress? Which to the most U. S. Senators? Why?

Ans.—New York, because it has the greatest population. Each state has two Senators.

7. What was the Emancipation? When and by whom issued, and when did it take effect?

Ans.—A Proclamation declaring that the slaves shall be forever free, issued by Abraham Lincoln, Jan. 1, 1863, and it took effect immediately. His proclamation of Sept. 22, 1862, was simply an announcement of his purpose.

8. What was the 15th Amendment? The 13th?

Ans.—The 15th guaranteed the right of suffrage to all citizens of the U. S., regardless of color, race or previous condition. The 13th embodied the emancipation proclamation.

9. Name ten important battles of the Civil War.

Ans.—Bull Run, Shiloh, Antietam, Monitor and Merrimac, Vicksburg, Gettysburg, Chickamauga, Wilderness, Atlanta, and Five Forks.

10. Name ten Union and five Confederate Generals of renown.

Ans.—*Union*—Grant, Sherman, Sheridan, McClellan, Halleck, Meade, Hooker, Pope, Foote and Porter. *Confederate*—Lee, Jackson (Stonewall), Price, Bragg and Beauregard.

GRAMMAR.

1. How many parts of speech in the English language? Which of these are not inflected? Which are declined? Which compared? Which are conjugated?

Ans.—Nine. Preposition, conjunction and interjection. Noun and pronoun. Adjective and adverb. Verb and participle.

2. What is the plural of *formula*? The feminine of *benefactor*? The principal parts of *fly*? The adjective form of *option*?

ANS.—Formulas or formulæ. Benefactress. Fly, flew, flown. Optional.

3. What is a conjunctive adverb? Write a sentence containing one and tell what word it modifies.

ANS.—It is an adverb used in joining two parts of a sentence, and modifying the verb in the subordinate; as, He came *after* I left.

4. What is a primitive word? A derivative word? A compound word? A simple word? A suffix? A prefix?

ANS.—A *primitive* word is one which is not traceable to some other word in the language for its origin, and *derivative* word is.

A *simple* word is one which is not made up of other words, and *compound* word is.

A *prefix* is that part of a derivative word which is placed before the radical, and a *suffix* is place after the radical.

5. Name and define the four parts into which English Grammar is divided.

ANS.—Orthography, Etymology, Syntax and Prosody. See text-book.

6. Correct, if wrong: To correctly report a speech is difficult. Who learned you to parse? Do you know who it was? Do you know who you are talking to? He being a stranger, we should not abuse him.

ANS.—To report a speech correctly is difficult. Who taught you to parse? Do you know to whom you are talking? Others are correct.

7. Write a sentence containing two singular subjects taken separately.

ANS.—He or she is to blame.

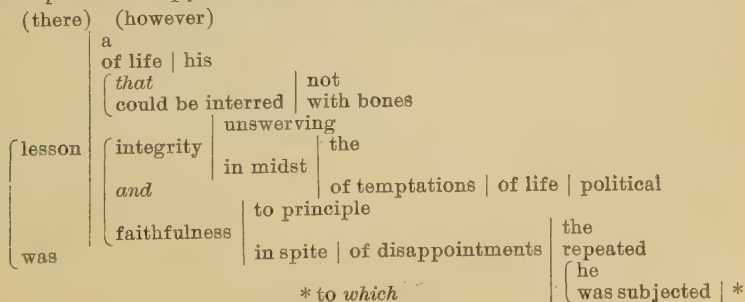
8. Write the possessive plural of brother-in-law, who, it, oxen, woman and child.

ANS.—Brothers-in-law's. Whose. Their. Oxen's. Women's. Children's.

9. *This* was *Webster's* opinion, the *most eminent lawyer* in the country. Parse italicized words.

ANS.—*This* is an adjective and modifies *opinion* understood. *Webster's* is a proper noun, possessing *opinion*. *Most eminent* is an adjective and modifies *lawyer*. *Lawyer* is a common noun, possessive case in apposition with *Webster*.

10. Diagram—There was however, a lesson of his life that could not be interred with his bones—unswerving integrity in the midst of the temptations of political life, and faithfulness to principle, in spite of the repeated disappointments to which he was subjected.



Editorial Notes.

In the next number a solution of a pulley-belt problem by A. M. Scripture, and an algebraic determination of the constant π , by Henry Gunder, will be published in connection with solutions of the first part of the May problems.

Please mark the answer to problem 5, p. 104, in last issue, 400 instead of 100. The operation is properly indicated.

The Ohio State Teachers' Association will be held at Chautauqua June 29, 30, and July 1. The Chautauquans propose to make it the most delightful and inspiring meeting ever held there.

Our friend L. W. Day, assistant Sup't of the Cleveland Schools, is secretary of the ex. Com. and is issuing an excellent programme.

For fifteen dollars any one from Western Ohio can make the trip and pay all expenses. The N. Y. P. & O. R. R. (Nipano) will convey parties from any point on their road to Chautauqua and return, at one cent a mile each way, and at still lower rates from the following points:

From Cin. and return, \$7.15; Middletown \$6.90; Dayton \$6.65; Springfield \$6.40; Urbana \$6.40; Marion \$5.30; Galion \$5.05; Mansfield \$4.75; Ashland \$4.45; W. Salem \$4.05; Burbank \$3.90; Sterling \$3.75; Wadsworth \$3.65; Akron \$3.45; Kent \$3.25; Creston \$3.75; Ravenna \$3.10; Cleveland \$3.65; Solon \$3.55; Garrettsville \$2.95; Phalanx \$2.80; Leavittsburg \$2.70; Warren \$2.65; Niles \$2.65; Girard \$2.65; Youngstown \$2.55; Hubbard \$2.45; Sharon \$2.40; Greenville \$2.00; Cortland \$2.45; Canfield \$3.00; Washingtonville \$3.20; Leetonia \$3.20; New Lisbon \$3.40; N. Lewisburg \$6.15; Richwood \$5.60.

These rates include steamboat fare between Lakewood (a station on Lake Chautauqua) and Chautauqua. Tickets will be on sale June 28, 29, and 30, and good until July 8 inclusive. The *Nipano* has always been very accommodating and friendly toward the teachers, and this year they intend to take especial care of their friends.

Boarding at the hotels \$2 per day; at private cottages from \$1 to \$1.50. Transportation on Lake between any two points 15 cents, by getting a coupon ticket good for ten single trips. These tickets are transferrable.

We wish here to extend our hearty thanks to the many friends of the *Visitor* in this county, for their continued support and cheering words; especially to the following for their kindness in securing subscriptions: D. B. Etzler, of Ithica; A. J. Bussard, Lightsville; J. M. Landis and A. McElwaine, of Greenville; C. A. Sebring, Wm. Sellers, and Orlando Gower, of North Star; O. P. Wilcox, M. A. Brown and E. M. Owens, of German; S. B. Keckler and John Fitzgerald, of Weavers; Aaron Wright, of Painter Creek; H. B. Maurer, of Bradford; E. B. and T. Hiestand, of Hagerman; J. H. W. Schmidt, of Ansonia; E. D. Willis, of Hill Grove; M. Corwin, of Arcanum; R. G. Howell, of Castine; W. W. Teegarden, of Woodington; D. W. K. Martin, of Webster; John Frobe, of Versailles; and others. Every teacher and aspiring student in Darke county should take their home educational magazine and study it.

ENGLISH GRAMMAR.

Answers to Queries.

1. Diagram the following sentences: A. J. BUSSARD, *Riegel, O.*

(a) Ten dollars fine for riding over this bridge faster than the walk.

ANS.—There is an ellipsis here which must be supplied before we can dispose of it. We prefer to read—"A fine of ten dollars for riding over this bridge faster than the walk has been established.

{	fine		a		ten		over bridge this		walk the	.
{	for riding		faster		{	is than		has been established		

(b) Not many generations ago, where you now sit, etc.

ANS.—See *School Visitor*, Vol. 4, p. 69; or Eubank's Key to Harvey's Analysis in which this and many other difficult sentences are diagrammed and explained. We will send this key to any address for two dimes. Too cheap for so many good things in grammar.

(c) It was now a matter of curiosity, who the old gentleman was.

ANS.—See Eubank's Key, or *School Visitor*, Vol. 4, p. 15.

2. Explain the peculiar uses of *it*?

S. M.

ANS.—*It* may be used to represent a noun implied in a verb; as, *It rains*, equivalent to *The rain rains*. An expletive (*ex*, out, and *pleo*, to fill); as, *It is* not known *who committed the crime*. Here the subject is a substantive clause, and is placed after the verb. Its place before the verb is filled up with *it*.

3. Does the participle ever have the construction of an adverb?

Id.

ANS.—Some grammarians say yes, but most of them use *it* as a noun or an adjective, only. In the sentence, "The boy came bounding up the lane," Holbrook gives *bounding* the construction of an adverb, modifying *came*. It is usually considered in the predicate with *came* and refers to *boy*. There are a few examples in which the participle performs the office of an adverb; as, *The water is scalding hot*. He is *fighting* mad.

4. Diagram—The town is six miles off. It is better for you to stay in-doors.

Id.

{	town the		is-off [] miles six		(it)	{	for you to stay in-doors		is-better

In parsing, say, "For you to stay in-doors," is a phrase partaking of the nature of an abstract noun, subject of *is*. *It* is an expletive.

4. Diagram: They placed upon my brow garlands which I felt I was not worthy yet to bear.

A. T. W.

{	they		garlands	{	I		{	I		was-worthy to bear yet		which
{	placed		upon brow my		not		{	was-worthy to bear yet		which		

Felt is an intransitive verb, modified by the adverbial clause that follows.

 MISCELLANEOUS DEPARTMENT.

 Answers to Queries.

989. What is coke? Answer at once.

Ans.—Charred pitcoal. As the distillation of wood leaves a solid residue of charcoal, so is coke the residue of the distillation of coal. A long ton of bituminous coal is said to yield 8,000 to 10,000 cubic feet of carbureted hydrogen gas, 1,100 to 1,300 pounds of dry, brittle coke.

Sir John Hacket and Octavius de Strada proposed in 1626 to convert coal into coke, and thus make a fuel as agreeable for chambers as wood or charcoal. EDITOR.

916. Who spent 16 years in writing a history and then burned it up?

Ans.—After Carlyle had spent many years in writing the history of the French Revolution, he lent the manuscript to a friend whose servant carelessly used it to kindle the fire. Carlyle read earnestly for three months and then wrote it over. J. D. BEARD, *Pyrmont, Ohio.*

920. Name the great men who have died within a year, and give their callings. J. H. SPENCER, *Hollansburg, O.*

Ans.—The reaper Death has cut a wide swath through the ranks of the distinguished people of the world during the past year. The following is a partial list of the eminent persons who have fallen before his relentless scythe.

Hon. Schuyler Colfax, ex-Vice-President and Statesman.

Prof. Benjamin Silliman of Yale College.

Col. John W. Phelps, first officer to arm slaves in the rebellion.

Joseph Grinnell, who secured the reduction of letter postage to five cents, a generation ago.

Francis S. Drake, eminent literateur of Boston.

Lady Ellen Fortesque, widow of Sir Wm. Fortesque.

Eliza Walker Blaine, only sister of James G. Blaine.

T. S. Arthur, writer and publisher, and author of "Ten Nights in a Bar-room."

Prince Orloff, a Russian diplomatist.

Prince Karageorgewitz, claimant to the throne of Servia.

Maj. Gen. Irvin McDowell, U. S. A.

Queen Dowager Emma, of the Sandwich Islands.

Hon. Frederick T. Frelinghuysen, ex-Sec'y of State.

Victor Hugo, the great poet and novelist.

Sir Julius Benedict, famous musical composer.

Archbishop Bourgeot of Montreal.

Prince Frederick Charles, nephew of Emperor William.

Ulysses S. Grant, one of America's greatest generals.

Sir Moses Montefiore, great Jewish philanthropist.

Richard Monckton Milnes, poet and critic.

Jas. W. Marshall, the discoverer of gold in California.

Earl of Shaftesburg, philanthropist and reformer.

Cardinal John McCloskey of New York City.

H. W. Shaw (Josh Billings), American humorist.

Mary Ann Booth, mother of Edwin and Wilkes Booth.

Gen. Geo. B. McClellan, U. S. A.

Alphonso XII., King of Spain.

Thos. A. Hendricks, Vice-President of the U. S.

Ex-Senator Robert Tombs of Georgia.

Wm. H. Vanderbilt, great railway magnate.

Winfield Scott Hancock, U. S. A.

Ex-Governor Horatio Seymour.

John B. Gough, temperance lecturer and writer.

Henry Norman Hudson, an American Essayist and Shakespearian critic, died Jan. 16.

Joshua B. Lippincott, an ambitious printer and publisher of Philadelphia.

Thaddeus Fairbanks, inventor of scales, April 12, 1886.

Gen. Durbin Ward, distinguished soldier, politician and lawyer, May 23, '86.

JOHN KNIESLY, *Gettysburg, Ohio.*

Answered by John L. Lott.

921. What is the Lover's Leap? Give history. *Id.*

Ans.—The "Lover's Leap," (also called Cape Ducato), is a promontory, rising perpendicularly 2,000 feet on the southern coast of Santa Mauro, one of the Ionian Islands, west of Greece. The poetess Sappho is said to have thrown herself into the sea from this eminence, because of the coldness with which her lover (Phaon the boatman of Lesbos) reciprocated her ardent affections.

J. W. KECKLER, *Ada, Ohio.*

The popular tradition that Sappho threw herself in despair from this white broken cliff, also known as the Leucadian rock, is rejected by some modern critics. She was a lyric poetess of great celebrity, born at Mitylene in the island of Lesbos, about 625 B. C. Addison says that her soul was made up of love and poetry; that she felt the passion in all its warmth and described it in all its symptoms; and that she was called by ancient authors the tenth muse. Her works are lost except a hymn to Venus. It is said by fable that Venus endowed Sappho's favorite Phaon with youth and beauty, because he once carried her across the water without charge.

EDITOR.

Ed. Rynearson, of Gettysburg, Ohio, gave a good answer.

922. Why was Alaska so named? Who introduced into Congress its purchase? *Id.*

Ans.—At the time of discovery by the Russians it was called by the natives *Alayeska*, which has changed through *Alaksa* and *Alashka* to its present form. William H. Seward, Secretary of State, presented the purchase of Alaska to Congress. He considered this negotiation the greatest accomplishment of his public career.

J. W. KECKLER.

923. What King entered the camp of his enemies as a spy? *Id.*

Ans.—Alfred the Great, one of the wisest and best of English sovereigns ascended the throne in the year 871, at the age of twenty-two. Soon after his ascension, he speedily gained some advantages over the Danes, who invested England, then called Saxony, and made a treaty with them; but they, receiving reinforcements, violated this treaty. The young prince fought eight battles with them in one year, but they swarmed on his coasts in greater numbers than before. The Saxons sought in vain to rally them. He then took the habit of a peasant, and offered his services to a herdsman, and faithfully tended his cows as they grazed. Once, when his mistress had desired him to watch and turn the cakes at the fire, his mind wandered to other things and the good wife scolded him for permitting the cakes to burn. Soon after this he disguised himself as a wandering minstrel, and, bearing a harp, he entered the camp of the Danes; and while his music entertained them, he observed their careless security. He also learned that they were about to celebrate a festival. Quitting the hostile camp, he revealed himself publicly to his rejoicing subject, who had thought him dead. They collected from all quarters, attacked the astonished Danes on the day of their celebration, and gained an easy, but complete victory.

JNO. KNIESLY.

Answered by Bruce Shepherd, *Greenville, Ohio.*

924. What was the "Gun-powder Plot?"

Id.

ANS.—It was a conspiracy on the part of Robert Catesby, Guy Fawkes, Sir Everard Digby, Thomas Percy, and other Roman Catholics to kill King James I., with the Lords and Commons, their motive being a fanatical zeal against the protestants. They hired a vault under the House of Lords, placed in it thirty-six barrels of powder, and arranged that Fawkes should explode it on the opening meeting of Parliament, Nov. 5, 1605, when the King, Queen, and Prince of Wales would attend, and then fly to Flanders by a ship on the Thames equipped by the money of William Tresham, a wealthy accomplice.

The Roman Catholic Peers and some others were to be saved. After all was ready, Lord Monteagle received an anonymous letter advising him to be absent from parliament the next day as, "God and man concurred to punish the wickedness of the times." It is supposed that Tresham wrote this letter, for he was Lord Monteagle's brother-in-law. This letter was communicated to the King, who on the night of the 4th caused diligent search to be made. Lords Chamberlain and Monteagle entered the Parliament House, and in a casual way told Guy Fawkes whom they found in the cellar at midnight with matches and tinder-box, and who passed as Percy's servant, that his master had laid in plenty of fuel. Trying to escape, he was arrested as he came out of the cellar, and tortured until he confessed his guilt. He was executed in January, and the other conspirators mentioned above were also punished by death in 1606. Tresham went free for a while, but he was at last apprehended and died in the tower of a natural disease.

A. L. MENDENHALL, *West Manchester, O.*

Answered elegantly by John Kniesly, Ed. Ryneerson, John A. Lott, *Greenville, Ohio*, and Wm. Kauffman.

925. Describe the first battle fought on American soil.

Id.

COMMENT.—This query is exceedingly comprehensive. The habitations of the ancient "Cliff Dwellers" in New Mexico, and the numerous defensive works of the Mound Builders in the Mississippi Valley, indicate that these people were assailed by their enemies, and probably many a bloody battle was fought on American soil in prehistoric times. Preliminary to the conquest of Mexico and Peru battles were fought of which we have no authentic history. The first conflict between the colonists and any of their civilized neighbors, occurred in 1613, when an expedition under Capt. Samuel Argall, of Jamestown, attacked and captured the French colony at Mt. Desert.

EDITOR.

926. Who wrote the "Song of Twickenham Ferry?"

WILLIAM HOOVER, *Athens Ohio.*

COMMENT.—We have the song. Theo. Marzials wrote the music, but the author of the words is not given.

EDITOR.

927. In what battle did the English first employ artillery?

GEO. L. SHANER, *Stewarts Station, Pa.*

ANS.—Artillery was first used by the English at the battle of Cressy, which was fought in the year 1346, between the English under Edward III. and the French under Philip VI. The French were defeated.

JOHN KNIESLY.

Edward III. invaded France in 1346, and after ravaging unopposed to near Paris, King Philip confronted him with a force of 60,000 strong. Edward made a rapid retreat down the river Somme, and a lucky crossing at Crecy or Cressy. Here on the night of Aug. 5, 1346, he arranged his men in three battalions, and every man lay on the ground. On Saturday morning (6th), they were thus found by the tumultuous French army, and the celebrated battle ensued, in which the English won a decisive victory. It was here that the Black Prince (son of Edward III.) gained his spurs, and adopted the triple feather crest of the Bohemian king who fought for France and was slain in this battle, with the significant motto, *Ich Dien*, still worn by the princes of Wales.

Ed. Ryneerson and Geo. L. Shaner gave answers.

EDITOR.

928. What were Arnold's last intelligent words? *Id.*

Ans.—"Bring me, I beg you, the epaulets and sword-knots which Washington gave me. Let me die in my old American uniform, the uniform in which I fought my battles. God forgive me for ever putting on any other."

GEO. L. SHANER.

929. When and by what colony was it enacted that wheat should be received in payment of all debts? H. A. WOOD, *Cleveland, O.*

930. When was the first temperance society in this country organized? *Id.*

Ans.—The first temperance society was organized in 1808, at Moreau, Saratoga Co., N. Y., by Dr. Billy J. Clarke, and Rev. Lebbeus Armstrong. Forty-seven male members signed the pledge under the name of "The Moreau and Northumberland Temperance Society." The pledge prohibited rum, gin, whisky, wine, or any distilled liquors whatever, and a fine of twenty-five cents was imposed for every violation of the pledge.

ED. RYNEARSON.

931. Describe in full the northern boundary of the U. S., giving the principal posts with inscriptions. J. Q. HELMAN, *Bradford, O.*

COMMENT.—We shall publish the answer soon. It is not complete yet.

932. Give names of the men who met in convention to adopt the constitution of Ohio. DARKE.

Ans.—We presume the querist means the *first* constitution, and we give the names of the men who met in convention at Chillicothe, Nov. 29, 1802. There were 110 delegates to the convention that framed the present constitution which was adopted in June, 1851. We can give the names of these, if desired.

Adams County.—Jos. Darlington, Israel Donalson and Thos. Kirker.

Belmont.—Jas. Caldwell and Elijah Woods.

Clermont.—Philip Gatch and James Sargent.

Fairfield.—Henry Abrams and Emanuel Carpenter.

Hamilton.—John W. Browne, Chas. Willing Byrd, Francis Dunlavy, Wm. Goforth, John Kitchel, Jeremiah Morrow, John Paul, John Riley, John Smith and John Wilson.

Jefferson.—Rudolph Bair, Geo. Humphrey, John Milligan, Nathan Updegraff, and Bezaleel Wells.

Ross.—Edward Tiffin, Michael Baldwin, Jas. Grubb, Nathaniel Massie and T. Worthington.

Trumbull.—David Abbott and Samuel Huntington.

Washington.—Ephraim Cutler, Benj. Ives Gillman, John McIntire and Rufus Putnam.

Edward Tiffin was President, and Thos. Scott, Secretary. EDITOR.

933. When did Sherman burn Atlanta? WARREN LOY, *Pymont, O.*

Ans.—The Michigan Engineers were detailed to burn Atlanta, and the work began on the evening of Nov. 13, 1864. A foundry worth \$500,000, was first in a blaze, then an oil-refinery, followed by a freight ware-house, and so on till many of the stores, hotels and business houses were in flames. The whole force was moved rapidly and grouped about Atlanta on that day. On the 14th the torch was placed to the private buildings, and the army commenced its memorable march to the sea. See Headley and Ridpath.

EDITOR.

934. What Vice-President was married to a mulatto?

D. M. BRUMGARD, *Lock Haven, Pa.*

Ans.—We know of no such alliance on the part of a vice president of the United States.

EDITOR.

935. On what occasion did a naval officer say, "Blood is thicker than water"?

J. M. GREENWOOD, *Kansas City, Mo.*

ANS.—While Capt. Josiah Tatnall, a native of Georgia and commander of the famous iron-clad *Merrimac*, was commanding a U. S. squadron in the East Indies, from 1856 to 1859, he had occasion to enter the Yellow Sea, in June, 1857. At the mouth of the Pei-ho, the jealous and treacherous Chinese fired upon the British fleet that lay at anchor, wounding the commander Sir Henry Hope. Capt. Tatnall, seeing the perilous situation of the British, dispatched a message to Admiral Hope, offering his assistance and exclaiming, "Blood is thicker than water," by which he meant that the natural propensities of the Chinese crop up notwithstanding the trammels of conventionality. He went to the relief of the British and saved them from disaster and evident ruin.

EDITOR.

936. Why does a little grease thrown into a kettle of hot foaming syrup reduce the foam?

LAWRENCE DUNLAP, *Zanesfield, O.*

937. Why is the title *Sir* given to Newton, Scott, Raleigh, *et al.*?

Id.

ANS.—"Sir (Fr. *sieur* and *sire*, contracted from *seigneur*; from Lat. *senior*, elder), a term originally corresponding to *dominus* in Latin, and which has come when appended to the Christian name and surname, to be the distinctive mark of knighthood. It was at one time used in addressing clergymen. To so great an extent did this usage obtain that a 'Sir John' came to be a common sobriquet for a priest. 'Sir' was here a translation of *dominus*, the term used for a bachelor of arts, originally in contradistinction from the *magister*, or master of arts, but eventually extended to the clergy without distinction. Used along with the christian name and surname, 'sir' is now applied exclusively to knights and baronets."

ED. RYNEABSON.

Because Newton was knighted by Queen Anne in 1705; the rank of baronet was conferred on Scott in 1820; and Raliegh received the honors of knighthood from Queen Elizabeth, into whose favor he first ingratiated himself by an act of gallantry. It is said that the queen in her progress from the royal barge to the palace at one time, came to a place where the ground was wet, and she hesitated. Raliegh immediately covered the spot with his richly-embroidered cloak, on which she stepped with much complacency.

EDITOR.

938. When were the capitals last changed of W. Va., La., and Dak.?

Id.

ANS.—Charleston became the capital of West Virginia, early in 1885; Baton Rouge of Louisiana, in 1879; and Bismarck of Dakotah, in 1883.

EDITOR.

940. Explain the meaning of the phrase, *Comin' thro' the rye*, as used by Burns?

A. A.

ANS.—The "rye" in this song written by Burns, is not grain at all; but it is the name of a small, shallow stream near Ayr, which, having neither bridge nor ferry in Burns' time, was forded by the people going to and from market. Custom allowed a lad to steal a kiss from any lass of his acquaintance, whom he might meet in midstream.

EDITOR.

941. Why is the climate of Michigan so much milder than that of Iowa?

C. W. BIGLER, *Gettysburg, O.*

ANS.—On account of the open waters of the adjacent lakes. The severe winds are generally from the west and northwest; but in sweeping across the open waters of Lake Michigan, they are softened and make the climate much milder than that on the western side of the lake. The mean annual temperature of Lansing is 46° Fah. while central Iowa is about the same, but the latter has greater extremes in temperature.

J. W. KECKRER.

942. What is the origin of *boycott* as used at present? C. A.

ANS.—*Boycott* is a word, which originated in 1880, at the time the Land League trouble occurred in Ireland, when the laborers were kept from helping Capt. Boycott to harvest his crop.

W. J. KAUFFMAN.

A few years ago an Irish land owner by the name of Boycott, turned out his tenants when they were unable to pay their rents. The poor people of the neighborhood instituted a "strike" against the rich and oppressive landlord, and would have no dealings with him whatever. They did all in their power to keep others from trading with him. Since then the term has been used in this country in allusion to the similar practice among labor organizations in their unfortunate controversies with capitalists and employers, and which is proving to be a powerful weapon.

EDITOR.

CREDIT.—Wm. Kauffman, *Marshallville, Ohio*, answered 927, 930 and 937; A. L. Mendenhall, *W. Manchester, Ohio*, 933. Came too late for publication.

QUERIES.

966. How is glucose made? PREBLE.

967. What was the "Lasker Incident," 1884? *Id.*

968. What was the "Doctors Mob" of revolutionary times? *Id.*

969. Where and what is *Krakatau*? *Id.*

970. What is the 5th essence—*quintessence*? *Id.*

971. What is the sacred "Stone of Scone" in English history? *Id.*

972. Was any President of U. S. ever married while in office? *Id.*

973. Locate the mints of the U. S. S. A. S.

974. In how many languages is the name of God known? *Id.*

975. What does the suffix *ana* signify? *Id.*

976. What were Pestalozza's nine laws of education? *Id.*

977. If the earth should stop revolving on its axis what would be the result? L. H. EVERETT, *New Lisbon, Ohio*.

978. Give etymology of *frustum*. Why *frustrum* formerly? S.

979. What became of the seal of Southern Confederacy? ED.

980. Who said "I will find a way or make one"? *Id.*

981. Whence came the Piqua tribe of Indians? DARKE.

982. Describe the *third* motion of the earth W. S. D.

983. Who invented the sword? Spinning Jenny?

NOAH COOL, *Laura, Ohio*.

984. Give incidents with which the names of Betty Zane, Mrs. Bratton, Mrs. Motte, Mollie Pitcher, Jane McCrea, Emily Geiger, Lydia Darrah and Molly Stark are connected in U. S. History.

EDITOR.

985. Name the three greatest clergymen, statesmen, senators, and women, now living in the U. S. P. J. SHAFER, *Red Wing, Minn.*

986. Soon after the war a Northern writer, who gave his initials "S. M. S." wrote a *History of the Civil War in the U. S.* Who was (or is) S. M. S.? JULIUS A. SHEETS, *Calvary, Va.*

987. How many satellites has Mars? By whom and when were they discovered? What is their time of revolution? R.

988. Does the sun always shine on some portion of the U. S. *Id.*

Answers should be received on or before July 10.

Notices of Books, Magazines, Etc.

PRACTICAL HOUSEKEEPING, A careful compilation of Tried and Approved Recipes. Buckeye Publishing Co., Minneapolis, Minn.

This excellent work has been thoroughly tried by the editor's household and never found wanting. It is dedicated to plucky housewives who master their work instead of allowing the work to master them, and it has reached an enormous sale in localities where its merits have become known. It commences with bread-making and goes through the entire catalogue of the culinary art, giving in all cases the best and most economical recipes. It has been carefully compiled from the choicest bits of experience of those who have traveled the daily round of household duties, and in families where the purse is not over-plethoric, it will prove a most excellent boon. Such a book is needed by every housewife, and teachers can make big money in its sale during vacation. Write to the publishers for terms to agents, prices, etc., if you mean business. If you are keeping house, get this work for the cook, and your bill of fare will be good, and the balance on the household ledger on the right side.

OUR LITTLE MEN AND WOMEN. This magazine, for youngest readers, has earned golden gratitude from teachers and parents this past year. While its short stories and beautiful pictures have made it welcome everywhere as a general Magazine for Little Folks, its series of instructive articles have rendered it of unrivalled value to educators. For 1886 several specialties have been prepared in accordance with the suggestions of teachers who wish to start their "little primaries" in the lines on which older brothers and sisters are being taught. As a beginning in American History, there will be twelve charming chapters about *The Adventures of Columbus*. *Little Talks about Insect Life*, *Our Colorado Pets*, "*Me and My Dolls*," and from time to time fresh "Stories about Favorite Authors" will be given, so that teachers and friends may have material for little literature lessons suited to young children. Seventy-five Full-Page Pictures. Only \$1.00 a year.

D. LOTHROP & CO., Publishers,

Franklin and Hawley Streets, Boston, Mass.

There are two little words in the voyage of life,

Which we use without thought every day,

That oft seal the fate of the little and great,

Whether near, or far away.

These suggestive words belong to the song and chorus "Yes or No" which is one of a few fine pieces sent us by the publishers, Oliver Ditson & Co., Boston. They are: Yes or No. (30 cts.) Song and Chorus by Stephen Massett. Hey Dolly! Ho, Dolly! (30 cts.) Song by G. Arlington. Champions Grand March. (30) W. O. Fiske. Meeting of the Birds Polka. (30 cts) By J. W. Wheeler. Pierrot. (30 cts.) Song by Hutchison. Caught. 30 cts.) Song by Romili. Wooing. (30 cts.) Song by Edith Cooke. The Eyes that look with Love on thee, (35 cts.) Ballad by Dr. O. P. Sweet.

HELPS TO LITERATURE STUDY.

1. Outline Studies in Holmes, Bryant, Whittier, their Poems. 32 pages. 10 cents. 2. Outline Studies in the Poetry and Prose of James Russell Lowell. 31 pages. 10 cts. 3. Ten Great Novels. Suggestions for Clubs and Private Reading. 23 pages. 10 cts. 4. Selections from Robert Browning and others, for Children, Teachers and Parents. 62 pages. 20 cts. 5. Unity Clubs, suggestions for the formation of Study Classes in Literature. 21 pages. 5 cents. *The five pamphlets, postpaid, 50 cents.* Address CHAS. H. KERR & Co., 175 Dearborn st., Chicago,

WANTED in every town, an intelligent lady of business experience, to introduce a work of necessity. Good pay to the right party. Profitable vacation work for teachers. Sanitary Pub. Co., 161 La Salle St. Chicago, Ill.



EDITED BY

JOHN S. ROYER.

VOL. VII.

JULY, 1886.

No. 7.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

874. Taking any scalene triangle, construct another equivalent to it, but *equilateral*.

By A. F. PARSONS, Arroyo Grande, Cal.

This problem required a construction, for which I offer the following.

Let ABC be the given triangle, scalene or obtuse. Through the vertex, C , draw a parallel to the base. Draw BC'' , cutting this parallel in C'' , making the angle $ABC'' = 60^\circ$. Then $\angle ABC = \angle ABC''$. In AB produced, take $BD = BC''$. On AD as a diameter, describe a semi-circle, and at B erect a perpendicular to AD , cutting the arc in E . In BC'' , or BC'' produced, and in AB , take BC' and BA' each equal to BE . Connect $A'C'$ and $A'BC'$ is the required triangle.

For $\triangle ABC = \triangle ABC''$, as they are on the same base, and between parallels, and $\triangle ABC'' = \triangle A'BC'$, for $AB \times BC'' = A'B \times BC'$. Therefore $AB \times BC'' = \sin ABC'' = A'B \times BC' \sin A'BC'$. In the same manner a triangle of any species may be constructed equal to any other triangle.

NOTE.—We omit the figure as any one can readily draw a diagram from the above explanation.

877. What must be the shape of a vertical pillar that it may appear of the same breadth all the way up to a spectator in a given position?

By A. F. PARSONS, Arroyo Grande, Cal.

Put h = horizontal angle subtended by the pillar, r = distance of observer from center of pillar, and v = any angle of elevation. Then

$$r : r \sin v :: r \sin \frac{1}{2}h : \text{radius of pillar at elevation } v.$$

But as r and h are constant, the radius of the pillar will vary as the

secant of the angle of elevation, while the height of the observed point varies as the tangent of the same angle. Now,

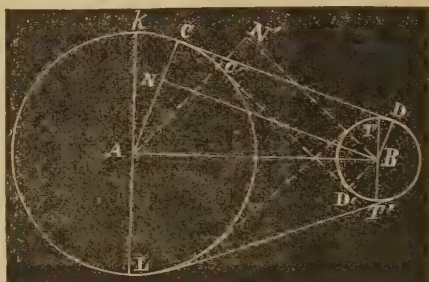
$$\tan : \sec :: \tan : \sqrt{(1+\tan^2)}.$$

The greater the tangent becomes, the more nearly will tangent and $\sqrt{(1+\tan^2)}$ increase in the same proportion. It is, therefore, evident that the contour of pillar will form a curve convex to the center line.

243. Two pulleys, one 40 in. and the other 10 in. in diameter, are 20 ft. apart from center to center. Find length of belt to reach around them.

By A. M. SCRIPTURE, Clinton, N. Y.

Let A and B be the centers of the pulleys. Draw a diameter to each pulley perpendicular to AB . Draw AC parallel to BD and perpendicular to CD , and BN parallel to CD ; $\angle CAK = \angle DBT = \angle ABN$. But for distinction, let $\angle CAK = \theta$, $\angle DBT = \theta_1$, $\angle ABN = \varphi$;



$C=360^\circ$; $B=180^\circ$; R = radius of larger pulley, r = radius of the smaller pulley, D = distance between their centers. Then the belt may be expressed by the formula:

$$\left\{ \frac{C-(B-2\theta)}{C} \times 2\pi R \right\} + \left\{ \frac{C-(B+2\theta_1)}{C} \times 2\pi r \right\} + 2D\cos\varphi.$$

The last term of this equation is equivalent to $2\sqrt{[D^2-(R-r)^2]}$. The angles CAK and DBT may be found from the $\triangle ANB$ as AB and AN are always known, from which BN is easily found, and ANB being a right angle A and B are readily determined.

The quantity within the first brackets is the amount of belt on the larger pulley; that within the second brackets the belt on the smaller pulley and the last term is the belt not touching either pulley. If the belt be crossed this formula will be true, as seen by reference to the dotted lines in figure.

$$\left\{ \frac{C-(B-2\theta)}{C} \times 2\pi R \right\} + \left\{ \frac{C-(B-2\theta_1)}{C} \times 2\pi r \right\} + 2D\cos\varphi.$$

REMARK.—This solution is supplementary to those by Prof. Seitz and Marcellus M. Thompson, Vol. 2, p. 140, and Vol. 6, p. 58, respectively. Mr. Thompson's is practically correct, giving length of belt to tenths of an inch, but when the pulleys differ largely in size, he does not claim that his formula will give correct results.

892. The cost of papering the walls of a room 26 feet long and 19 feet wide with paper 2 feet wide at 7 cents a yard, is \$12.60; how high are the walls?

By GEO. C. RUSSELL, *Petaluma, Cal.*

Total length of walls is $(26+19) \times 2 = 90$ ft.; it takes $12.60 \div .07 = 180$ yds. of paper, and since each yard contains 2×3 , or 6 sq. ft., the surface papered is $180 \times 6 = 1080$ sq. ft.; hence $1080 \div 90 = 12$ ft., the height of room.

893. The face value of two notes is \$1020, both due in 2 years. One is discounted at 5% bank discount and one 5% true discount, and the entire proceeds is \$923. Find the face of each. *Id.*

By B. F. FINKEL, *Amanda, Ohio.*

Let $100\% =$ face of note discounted by true discount, and \$1020 $- 100\% =$ face of the other. The present worth of the first is $100\% \div 1.10 = 90\frac{1}{11}\%$, and proceeds of the second are $\frac{9}{10}$ of $(\$1020 - 100\%) = \$918 - 90\%$. Amount of both is $\$918 - 90\% + 90\frac{1}{11}\% = \923 ; whence $100\% = \$550$, and $\$1020 - \$550 = \$470$.

NOTE.—The editor favors the rejection of the three days grace in problems where true and bank discount are compared, and the sum realized is for the time when the notes were to run and not for maturity. Custom allows three days grace on all notes, whether equitably discounted by individuals or otherwise by banks.

894. A certain quantity of air has a volume of 195.5 cu. ft. at 27.8° . What will be its volume at 100° ? By proportion. *Id.*

By A. F. PARSONS, *Arroyo Grande, Cal.*

Ure says the expansion of gases is uniform for all temperatures, and from Haswell's tables the increase of volume for each 490° of increase in temperature equals the original volume. Hence, by proportion, we have

$$1 : 1 + [(100 - 27.8) \div 490] : : 195.5 : (224.5, \text{Ans.})$$

But from Dalton's tables the co-efficient of expansion is 1.152 from 32° to 100° , and .996 from 32° to 27.8° ; this gives the volume under consideration 196.3 at 32° and 226.02 at 100° .

By A. L. FOOTE, *Merrick, N. Y.*

It has been found by experiment that for each degree's increase of temperature, the volume increases .002020275. Hence, we have

$$195.5 \times (1 + 72.2 \times .002020275) = 224.11836 \text{ cu. ft.}$$

By PROF. COOPER D. SCHMITT, *Woodstock, Va.*

Let $v =$ volume at 27.8 and $v' =$ volume at 100° . Then by chemistry, we have $v' = v(1 + .003665t)$, where $t = 72.2^\circ$, the number of degrees the temperature is raised. Substituting values of v and t , we find $v' = 247.2318$ cu. ft.

NOTE.—Prof. Schmitt takes the temperature as being Centigrade and the others Fahrenheit, which accounts for the variation in results.

895. Three persons, A, B and C are respectively 30, 40 and 50 years of age, and are to receive a sum of money at the end of 10 years, provided they live that time, in which case it is to be shared equally; but if A dies, B and C are each to have $\frac{1}{2}$ of A's in addition to their own. If B dies A and C are to have each $\frac{1}{2}$ of his in addition to their respective share, and in like manner, if C dies A and B are to have $\frac{1}{2}$ of his. If any two of them die the surviving one is to have $\frac{1}{2}$ of their shares. Their whole chance is worth \$1260, payable at the end of 10 years. Now what was the sum of money each was to receive, supposing 75 die out of 4010 between the ages of 30 and 40, 82 out of 2448 between 40 and 50, and 80 out of every 1632 between the ages of 50 and 60? A. L. FOOTE.

By A. F. PARSONS, Arroyo Grande, Cal.

Let A, B, C, be the chances of the men A, B, C, respectively, living to the end of 10 years, and a, b, c , the probabilities of their dying during that time. Then

- | | |
|------------|--|
| (1), ABC | is the probability of all living to the end of 10 years; |
| (2), AbC | " B only dying during 10 years; |
| (3), ABc | " C " " " |
| (4), aBC | " A " " " |
| (5), Abc | " A " living to end of 10 years; |
| (6), aBc | " B " " " |
| (7), abc | " C " " " |

Under (1) each gets $\frac{1}{3}$ of the whole amount; under each of (2), (3), and (5), A gets $\frac{2}{3}$; under each of (3), (4), and (6), B gets $\frac{2}{3}$; and under each of (2), (4), and (7), C gets $\frac{2}{3}$. Then A's probability is worth

$$\frac{1}{3}ABC + \frac{2}{3}(ABc + AbC + abc) = \frac{4}{3}A - \frac{1}{3}ABC \dots (a).$$

The expression for the value of B's and C's chances are the same, substituting B and C for A in the first term of the second member of (a). By adding the total value of the chances, we have

$$\frac{4}{3}(A+B+C) - \frac{1}{3}ABC = 1260.$$

Or by substitution $A = \frac{787}{802}$, $B = \frac{1183}{1224}$, $C = \frac{97}{102}$, $a = \frac{105}{802}$, $b = \frac{41}{1224}$, $c = \frac{5}{102}$, and $\frac{890070345}{901152864}$ of the required sum is \$1260; hence the required sum is \$1275.688, and each man's share is $\$1275.688 \div 3 = \425.229 .

A's expectation is $\frac{303112468}{3031152864}$ of \$1275.688 which equals \$428.525

B's " $\frac{296787491}{901152864}$ " " 420.138

C's " $\frac{290570387}{901152864}$ " " 411.337

Total \$1260.000

It was assumed that the shares were equal; otherwise there would have been three unknown quantities and but one equation. Also, the sum \$1260 was taken instead of its present worth, for although it is the value of their chances at the end of ten years, the required sum is the amount each is to receive at the end of ten years.

Credits and solutions next month. Also Mr. Gunder's paper.

Examination Questions.

Used at Greenville, Ohio, Saturday, July 3. Next examination is to be held Aug. 7. Tell your friends to subscribe for the *Visitor*.

ARITHMETIC.

1. How many gallons of water does a pipe 3 inches in diameter discharge in an hour if the current flows 200 ft. per minute?

Ans.—The volume of water discharged is equal to that of a cylinder 200×60 , or 12,000 ft. long and 3 in. in diameter; $3^2 \times .7854 \times 12000 \times 12 \div 231 = 4406.4$ gal.

2. How large a square can be cut from a circle 50 in. in diameter?

Ans.—The diameter of the circle is the diagonal of the square; therefore $\sqrt{(50^2 \div 2)} = 35.3553391$ in. is the side of the square.

3. The product of 6 equal numbers is 191,102,976; find one of the numbers.

Ans.—The sixth root of the product is one of the factors, or the cube root of the square root; thus, $\sqrt[6]{(191102976)} = 24$.

4. Find the difference of time between two cities one in longitude $30^\circ 16'$ E., and the other in longitude $90^\circ 3' 28''$ W.

Ans.—The difference of longitude is $120^\circ 19' 28''$, which, divided by 15, gives 8 hr. 1 min. $17\frac{1}{3}$ sec.

5. At 25¢ per cu. yd. find the cost of digging a trench 650 ft. long, $2\frac{1}{2}$ ft. wide at the top and $1\frac{1}{2}$ ft wide at the bottom and $3\frac{1}{4}$ ft. deep.

Ans.—The cost is $650 \times 2 \times 3\frac{1}{4} \div 27 \times .25 = \39.12 .

6. At your own estimation of the dimensions of this room, find cost of plastering the same at 9¢ a sq. yd., no deductions being made.

Ans.—Suppose the room to be 40 by 60 ft. and 18 ft. high. Then the cost is $(200 \times 18 + 40 \times 60) \times .01 = \60 .

7. Sold two horses for the same sum; I gained 25% on the first and lost 25% on the second. I lost \$30 in the whole transaction. Find cost of each horse.

Ans.—Let 100% = selling price of each. Then 80% = cost of first and $133\frac{1}{3}\%$ = cost of second, and the loss $(80 + 133\frac{1}{3}) - 200 = 13\frac{1}{3} = \30 ; $1\% = \$2\frac{1}{4}$ and $80\% = \$180$, cost of first; $133\frac{1}{3}\% = \$300$.

8. If $\frac{1}{4}$ of 20 were 6 what would $\frac{1}{5}$ of 40 be? Find the simple interest of \$500 for 1 yr. 30 da., at 6%.

Ans.—To first part, 9¢. See Vol. 6, p. 201, and Vol. 7, p. 10. To second part, \$32.50.

9. A, B, and C are employed to do a certain piece of work for \$26.45. Find the share of each provided A and B together do $\frac{3}{4}$ of it, A and C $\frac{9}{10}$ of it, and B and C $\frac{13}{20}$ of it.

Ans.—All do $(\frac{3}{4} + \frac{9}{10} + \frac{13}{20}) \div 2 = \frac{11}{10}$, of which A does $(\frac{11}{10} - \frac{13}{20}) = \frac{1}{2}$, B $\frac{1}{4}$, and C $\frac{2}{5}$. Or they work in proportion of 10, 5, and 8; $\therefore$ A gets \$11.50, B \$5.75, C \$9.20.

10. How many barrels in a tank in the form of the frustum of a pyramid, 5 ft. deep, 10 ft. square at the bottom and 9 ft. square at the top?

Ans.—The solidity of frustum is $[10 \times 9 + \frac{1}{3}(10 - 9)^2] \times 5 = 451\frac{2}{3}$; $451\frac{2}{3} \times 1728 \div 231 \div 31.5 = 107.26$ bbl. in tank.

GEOGRAPHY.

1. Name the townships in Darke county.

ANS.—Harrison, German, Washington, Jackson, Mississinawa, Butler, Neave, Greenville, Brown, Allen, Twin, Van Buren, Richland, York, Wabash, Monroe, Franklin, Adams, Wayne and Patterson.

2. What are the natural divisions of time?

ANS.—The solar day, the solar year, and the lunar month may be called the *natural* divisions of time; but we take the day as the unit of time which nature supplies “ready-made.” Our civil month and year are conventional. At the time of creation, the day and the night were the only measures of time; that is, each indicated the period in which light or darkness prevailed. See p. 108, *May Visitor*.

3. What is the area of the U. S.; of Alaska; of Ohio?

ANS.—Area of the U. S. is 3,602,990 sq. mi.; of Alaska, according to latest computations, 531,000 sq. mi., with over 8000 miles coast line; Ohio, 40,760.

4. What and where are the following: Atlanta, Trinidad, Bahia, Morea, Crimea?

ANS.—Atlanta, capital of Ga.; Trinidad, island north of S. A.; Bahia, seaport of Brazil; Morea, peninsula of southern Greece; Crimea, peninsula projecting into the Black Sea.

5. On what waters would a vessel sail in going from Odessa to London?

ANS.—Black, Marmora, Mediterranean, and North Seas, Bosphorus, Dardanelles, Gibraltar and Dover Straits, English Channel, Atlantic Ocean, and Thames River.

6. What countries in Europe are in the same latitude as Ohio?

ANS.—Spain, Portugal, Italy, Turkey, and Greece.

7. What is a zone? Give the boundaries of the mathematical and physical zones.

ANS.—See p. 109, current volume, and p. 213, Vol. 6, where explanations are given. To questions answered before we shall give references only. Preserve every issue of the *Visitor*.

8. What are rapids, cascades, cataracts?

ANS.—See text-book.

9. What are the chief mineral products of Ohio?

ANS.—Coal and iron.

10. What natural divisions of land are the following: Newfoundland, Cod, Italy, Cuba, Panama?

ANS.—Island, Cape, Peninsula, Isthmus.

SPELLING.

Correct the following where necessary: 1. Sissors; 2. Parallell; 3. Conshus; 4. Furlow; 5. Skeamer; 6. Particle; 7. Supercede; 8. Bizness; 9. Preseeding; 10. Capillary; 11. Ventillate; 12. Croka; 13. Sinagog; 14. Isosceles; 15. The surgen rowed the horse a few miles up the rode, stopt, tyde hime & waided threw the grass to the lake, rode across on the bote against the tied, chanting a butiful himn.

ANS.—Scissors, parallel, conscious, furlough, schemer, particle, supersede, business, preceding, capillary, ventilate, croquet, synagogue, isosceles. The surgeon rode the horse a few miles up the road, stopped, tied him and waded through the grass to the lake, rowed across on the boat against the tide, chanting a beautiful hymn.

GRAMMAR.

1. Define clause, sentence, paragraph, simile verbal noun.

Ans.—To first two, pp. 15 and 43. Simile, p. 62. Verbal noun, p. 43. A paragraph is a distinct part of written discourse.

2. Give the principal parts of the verbs hew, hide, drawn, knit, shear.

Ans.—Hew, hewed, hewn; hide, hid, hidden; draw, drew, drawn; knit, knitted, knittid; shear, sheared, shorn.

3. Give feminine of Czar, Jew, host, prophet, actor.

Ans.—Czarina, Jewess, hostess, prophetess, actress.

4. Write short sentences showing the different constructions of the words *what* and *as*.

ANS.—The constructions of *what* may be—(1) As a noun, subject and object; (2) relative pronoun, object; (3) interrogative pronoun, subject and object; (4) adjective; (5) adverb; (6) interjection. *As*, same as *what* in (1) and (2); conjunction; preposition; conjunctive adverb.

5. Write four short sentences using the noun *boys* in each, but with different constructions.

ANS.—Boys, come here. Boys should behave. I teach the boys. The boys' hats were sold.

6. What do you understand by the term *root* in language; also by the prefix and suffix.

Ans.—*Root* is an original form of speech, or a word from which others are formed. For suffix, etc., see p. 135.

7. What parts of speech are subordinate connectives?

Ans.—See pp. 88 and 110.

8. What are auxiliary verbs? Name them. In what tenses are they used?

Ans.—*Helping verbs*, by which the variation of the verb in conjugation is chiefly accomplished. *May, can, shall*, and *must* are always auxiliaries. *Will, have, do, be* and *let* are sometimes principal verbs, present, past and present perfect. See p. 42.

9. Parse italicized words in the 10th.

10. Analyze: *Amongst* the number was an old man who had fallen an early *victim* to adversity, and *whose* days of imprisonment, *reckoned* by the notches *which* he had cut on the door of his gloomy cell, *expressed* the annual circuit of more than fifty suns.

an
 old
 { *who*
 had fallen | [] victim | an
 and | *whose* | early
 to adversity
 { man | days | of imprisonment | the
 reckoned | by notches | { he
 had cut | *which*
 on door | the
 his
 of cell
 gloomy
 { expressed | circuit | the
 annual
 of suns | more | { suns | fifty
 are | *than*
 was | amongst number | the

Victim is in the objective case without a governing word.—*Harvey.*

HISTORY.

1. Give an account of the introduction of slavery into the U. S.

ANS.—The Portuguese, who possessed a large portion of the African coast, were the first to introduce slavery into the New World. Negro hands laid the foundation of St. Augustine, for the Spanish brought slaves as early as 1501. The Dutch man-of-war brought 20 into the Jamestown colony in 1619. In 1626 slavery began in the New Netherlands.

2. What causes led to the civil war?

ANS.—States rights question. Slavery. Different labor systems.

3. What was the Geneva Tribunal?

ANS.—See p. 39.

4. Who discovered the American continent before Columbus did, and when and where?

ANS.—By the Northmen, along the coast of Labrador and New England states, in 1000.

5. When and where was the first colony formed on the American continent?

ANS.—At Vinland, (R. I.), in 1007, by Thorfinn Karlsefne. Here is where his son Snorri was born.

6. What States were admitted into the Union during Monroe's administration.

ANS.—Miss., Ill., Ala., Me. and Mo.

7. When and where was the Declaration of Independence passed?

ANS.—At Philadelphia, July 4, 1776.

8. What was the Boston Port Bill and when was it passed?

ANS.—See p. 188, Vol. 6.

9. What State is sometimes called the mother of Presidents? Why?

ANS.—Virginia, because it furnished Washington, Jefferson, Madison and Monroe.

10. When and where did the first Continental Congress convene?

ANS.—In Carpenter's Hall, Philadelphia, Sept. 5, 1774.

Editorial Notes.

Our friends will please not forget to represent the *Visitor* at the institutes. Sample copies will be sent upon application.

Each volume of our magazine is to contain about 250 pages. Each of the six numbers of the current volume contains 24 pages and this issue less. The August number will have 24 pages of very interesting matter.

Joel Dorman Steele, author of Barnes's Histories, an excellent man as well as scholar, died very suddenly at his home in Elmira, N. Y., May 25. We had some valuable correspondence with him, and his memory shall ever be fondly cherished. He was an appreciative reader of the *Visitor*.

The Ohio Teachers' Association had a pleasant and profitable meeting at Chautauqua. Next year, in view of celebrating the hundredth anniversary of the Ordinance of 1787, the meeting will be held somewhere in Ohio, most likely at Delaware. We may publish the Ordinance sometime, for our readers who have never seen that unique and most excellent document, will appreciate it very highly.

Persons desiring their *Visitors* bound, should present them on or before Sept. 1, or leave them in care of J. M. Bickel, Greenville. Charges, 25 cts. for binding each volume and 10 cts. postage. Vols. 1, 2, 3, 4, 5 and 6, bound together will cost \$1.50; Vols. 4, 5 and 6, \$.75, net. Full cloth, with title in gold.

ENGLISH GRAMMAR.

[We commend the following rules of construction and remarks to such of our readers as consider rules an essential part of parsing. They are from Thos. Eubank, who has been requested to write a grammar, embodying his latest and best views on the subject.—*Ed.*]

I. A noun or pronoun in the nominative may be the subject or attribute, or be independent.

II. A noun or pronoun in the objective may be the object of a verb or preposition, or be the subject or attribute of an infinitive.

III. A noun or pronoun in the possessive may modify some noun or be the attribute.

IV. An adjective may modify some noun or be the attribute.

V. A finite verb is the predicate or copula of a proposition.

VI. An infinitive may be the predicate or copula of an abridged proposition (infinitive), or be used as a noun, adjective, or adverb.

VII. A participle may be the copula of an abridged proposition (participial), or be used as a noun, adjective, or adverb.

VIII. An adverb may modify a verb, adjective, or adverb, or be used independently.

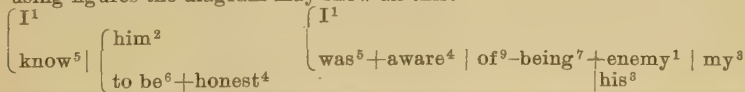
IX. A preposition shows the relation of its object to the word modified by the phrase.

X. A conjunction may connect words, phrases, or clauses, or be used independently.

XI. An interjection has no dependence on other words.

Remarks.—A rule for the agreement of pronouns with the nouns they represent in person, number, and gender, is necessary for the correction of errors, but is not needed in parsing.

Possessives may be included in the rule for adjectives. I am not sure that either is ever the attribute. If we say, "They are rich," is not some noun as *people* understood after *rich*? But if we predicate the quality *rich* of *they*, so may we predicate possession; as, "The horse is *mine* but the buggy is *John's*." Never parse the attribute adjective or possessive as modifying the subject. It is a contradiction to call a principal element a modifier. The agreement of finite verbs with their subjects in person and number should be treated in remarks under the rule for finite verbs. The office of the verb is as stated in the rule. The parsing of an infinitive, having a subject or attribute or both, and of a participle, having an attribute, should conform to the analysis. Thus in the sentence, "I know him to be honest," the object of *know* is the abridged proposition (infinitive) *him to be honest*; of which *him* is the subject (Rule 2) and *to be honest* the predicate, *to be* the copula (Rule 6) and *honest* the attribute (Rule 4). In the sentence, "I was aware of his being my enemy," *being enemy* is the object of the preposition *of*, *being* the copula (Rule 7) and *enemy* the attribute (Rule 1); *his* modifies *being enemy* (Rule 3) which is used as a noun. By using figures the diagram may show all this.



When an infinitive or participle is used as a noun, adjective, or adverb, parse by the rule for noun, adjective, or adverb.

No rule for apposition is here given; but is any necessary? In the sentence, "It is he, even he," does *he* (2) modify *he* (1)? or in the sentence "You yourself told me," does *yourself* modify *you*? Compare with the following: "Hear, father, hear our prayer!" Does the second verb *hear* modify the first? "There, there, that will do." Is *there* (2) a modifier of *there* (1)? "The thoughts of youth are long, long thoughts." Does the second *long* modify the first or do both adjectives modify the same noun? These repeated or equivalent subjects, attributes, etc., seldom have connectives. Sometimes they are connected by one of the conjunctions *and*, *or*, *even*, *viz.*, etc.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

ADDITIONAL to 886.—The bill passed, and Fitz-John Porter now becomes Major-General in the army on the retired list, having the same rights as if he had served continually.

EDITOR.

ANS. to 930.—In *Drill Lists in U. S. History*, by R. H. Holbrook, Part 1, p 23. there are two temperance societies named as having been organized before the one named in *June Visitor*. They were the First Temperance Society, Litchfield County, Conn., 1789, and the First Total Abstinence Society, by the Methodist Episcopal Church of Virginia in 1797. H. G. THOMAS, *German, O.*

ANS. to 942.—Capt. Boycott was the agent of the Earl of Erne. The tenants hated him and the people sympathized with the tenants. It was resolved by both to leave Capt. Boycott alone. Everybody did so. No one would speak to him, sell to him, work for him, or aid him in any way. The result was that Capt. Boycott had to leave Ireland or starve. We have added the word *boycott* to the language within the past few years, and there has not been time for it to get into the dictionary. J. H. W. SCHMIDT, *Ansonia, Ohio.*

931. Describe in full the northern boundary of the U. S., giving the principal posts with inscriptions. J. Q. HELMAN, *Bradford, O.*

ANS.—Commencing at the east, the river St. Croix is taken to its source, where a monument was designated by 5th article of the treaty of 1794; thence north to the middle of the channel of St. John River; thence up said river to the mouth of the St. Francis; thence up the middle of this river and the lakes through which it flows to the outlet of Lake Pohenagamook; thence southwesterly to a point on the N. W. Branch of St. John River, ten miles from the nearest point of the main branch of the St. John; thence about S. 8° W. to a point where parallel 46°25' intersects the S. W. Br. of the St. John; thence southerly by said Branch to its source in the highlands at the Metjarmette portage; thence along said highlands which form the water shed of the St. Lawrence and Atlantic river systems, to the head of Hall's Stream; thence down the middle of said stream to the 45th parallel; thence up the St. Lawrence, in curved lines, and keeping 100 yards distant from certain islands, to Lake Ontario; thence along the middle of said lake to a point opposite the mouth of Niagara River; thence to and up said river to the point of Horse Shoe in the Great Falls; thence to Lake Erie and along the middle thereof to the mouth of Detroit River; thence along the middle of said river, and Lake St. Clair, and St. Clair River, and Lake Huron, making the passage into Lake Superior between the islands of Drummond and Little Manitou (now Cockburn), Drummond and St. Joseph and through the Neebish Channel; thence in the middle of Lake Superior to a point several hundred yards northeast of Isle Royale; thence through the middle of the sound between said island and the mainland to the mouth of Pigeon River; thence up the middle of this river to and through north and south Fowl lakes, and the lakes of the height of land between lakes Superior and Woods to the mouth of Rainy Lake River; thence through Lake of the Woods to the most northwestern point thereof being in Lat. 49°23'55" and Long. 95°14'38"W.; thence due south to the 49th parallel; thence on said parallel to the middle of Georgia Gulf; thence southerly by the Canal de Haro, leaving the island of San Juan to the east, to and through the middle of the strait of San Juan de Fuca to the Pacific Ocean.

The posts, monuments, and inscriptions are too numerous to mention. For further particulars see *Bulletin of the U. S. Geological Survey, No. 13*, by Henry Gannett, which gives the boundaries of the United States and of the several states and territories. 1885. 8°. 135 pp. Price 10 cts. Address "Director of the U. S. Geological Survey," Washington, D. C.

EDITOR.

943. What portion of country is known as the *Pan Handle*?

D. W. K.

ANS.—That part of W. Va. which lies between Ohio and Pa. is called the pan-handle, the remaining part being the pan.

S. B. KECKLER.

That part of W. Va. between Ohio and Pa. Also, the northern part of Idaho. Also, western part of Indian Ter.

B. F. FINKEL.

944. What is meant by *The Triple Alliance*, *The Underground Railroad*?

Id.

ANS.—The Triple Alliance implies two different treaties: 1st, a treaty concluded in 1668 at The Hague between England, Holland, and Sweden, having for its object the protection of the Spanish Netherlands and the checking of the conquest of Louis XIV.; and 2d, an alliance concluded in 1717 between Great Britain, France, and Holland against Spain, which embraced among its stipulations that the Pretender should quit France and that the treaty of Utrecht should be carried into effect as regards the demolition of Dunkirk. The protestant succession was guaranteed by this treaty in England, and that of the Duke of Orleans in France.

J. D. BEARD.

When African Slavery existed as an institution in the Southern States, there was an organization in most of the free states known as the "Underground Railroad." Although the term was generally used to designate the society which gave aid and assistance to such fugitives as had escaped from servitude and sought liberty, yet few persons in any community had any practical knowledge of the workings of this mysterious and humane society. Slaveholders in pursuit of fugitives would find their subjects suddenly disappear, and once the capture seemed sure, when trace was lost. The slave hunters returned, giving their opinion that the abolitionists had an "Underground Railroad" on which their slaves were spirited away. From this originated the name which the abolitionists adopted for their organization.

S. B. KECKLER.

945. Give a brief account of Leonard Calvert's company of Catholics and their voyage to the New World. Name the two vessels that carried them.

Id.

ANS.—Sir George Calvert, the first Lord Baltimore, applied to Charles I. for a patent for the region north of the Potomac River, and was given a territory corresponding very nearly to the present State of Maryland in extent. Calvert, dying before the patent was issued, left his son, Cecil, heir to his designs as well as his title. The charter granted to his father was issued to him, and he proceeded at once to collect a colony for the settlement of Maryland. Lord Baltimore delegated the task of conducting the emigrants to Maryland to his brother Leonard Calvert. On Friday, Nov. 22d, 1632, a company of 200, chiefly Roman Catholics of good birth, with their families and servants, sailed from England in the "Ark" and the "Dove," the former a ship of large burthen, the latter a small pinnace. The voyage was made by way of the West Indies, and the Chesapeake was not reached until the 24th of February, 1634. The ships anchored off Old Point Comfort, and were visited by Sir John Harvey, Governor of Virginia, who had been commanded by the king to welcome the new colony with kindness.

JOHN KNIESLY.

946. What is meant by the *Siege of Ninety-six*?

DARKE.

ANS.—Ninety-Six was a British post in the Revolution, 150 miles north-west of Charleston, S. C., strongly fortified and garrisoned by 550 Tories under Col. Cruger. On May 22, 1781, Gen. Greene appeared before it, and with the aid of Kosciusko, commenced a regular siege which lasted four weeks. The Tories made a gallant resistance, in the hope of relief; and though Greene pushed the work with unrelenting energy, the approach of Rawdon, the British commander, compelled him to raise the siege after an unsuccessful assault.

EDITOR.

947. Who first contrived the method of printing?

Id.

ANS.—The credit of discovering this simple yet marvellous art is contested by the Dutch in favor of Lawrence Coster, between 1420 and 1426, and by the Germans, on behalf of Johann Gansfleisch of the Gutenberg family, about 1438.

ED. RYNEARSON.

The invention of printing with movable type is believed to have been made by John Gutenberg of Metz. He had conceived the plan about 1438, but on account of poverty could not put it into execution until 1455, when John Faust, a wealthy merchant, assisted him in printing the *Mazarin*. The art was introduced into England by Wm. Caxton. His first printing press was set up at Westminster, and its first work was the game of chess in 1455.

M. W. HOLLINGER.

950. What was the Massacre of the Glencoe?

C. W. B.

ANS.—It was a wholesale slaughter of the Macdonald tribe in Scotland, merely for not surrendering before the time stated in King William's proclamation (Dec. 31, 1691). Sir John Dalrymple, the Master, afterward the Earl of Stair, and their inveterate enemy, obtained a decree "to extirpate that pack of thieves," which the King is said to have signed without perusal. Every man under 70 was to be slain, and the mandate was executed with the blackest treachery. The 120 soldiers, forming a part of the Earl of Argyle's regiment, were hospitably received by the Highlanders. Feb. 13, 1692, the massacre began. About 60 were brutally slain and many women and children were turned out naked in a dark and freezing night, and all perished by cold and hunger. This black deed excited great indignation in England and an inquiry was set on foot, but no punishment followed.—*People's Encyclopedia*. S. B. KECKLER.

When William and Mary ascended the throne in 1688, Scotland accepted their allegiance with the exception of the Jacobites. After fruitless efforts to win them over, the king issued a proclamation that all who would not take the oath of allegiance on or before Dec. 31, 1691, would be deemed rebels. All did so, except MacIan, chief of the Macdonalds, who lived in Glencoe, a mountain valley in Western Argyleshire, Scotland. MacIan with his clan appeared at Ft. William Dec. 31, to take the oath, but to his surprise no one was there to administer it, and being compelled to go to another point, he did not find the proper authority till Jan. 6, 1692. Sir John Campbell, sheriff of Argyleshire, was finally induced to administer the oaths, but John Dalrymple, William's secretary for Ireland, concealed the facts from the king and obtained an order for the military execution of MacIan and his clan. A body of soldiers under Campbell, accordingly marched to Glencoe, professed to come in peace and shared their hospitality for a fortnight, then on the 13th of February, 1692, massacred all the inhabitants of Glencoe Valley, sparing neither age nor sex. Their cattle were driven away and their houses burned. M. W. HOLLINGER.

There was a civil war in Scotland and the Edinburgh authorities issued a proclamation exhorting the clans to submit to William and Mary, and offering pardon to every rebel who would swear on or before Dec. 31, 1691, to live peaceably under the government of their majesties, and threatening to treat all who refused to do so as enemies and traitors. The chiefs of all the clans submitted before Dec. 31 except MacIan, the chief of the Macdonalds of Glencoe, whose submission was delayed until Jan. 6. The magistrate made an explanation of the circumstances of the case. The certificate was never laid before the council, but was suppressed by an intrigue, directed (it is supposed) by the Master of Stair, (Sir John Dalrymple, afterwards second Viscount and Earl of Stair,) on whom rests the chief blame of this odious transaction. The Master of Stair obtained the king's signature to an order directed to the commander of the forces in Scotland, and which runs thus: "As for MacIan of Glencoe and that tribe, if they can well be distinguished from the other Highlanders, it will be proper, for the vindication of public justice, to extirpate that set of thieves."

The morning of Feb. 13 was chosen for this inhuman massacre, and on the night of the 12th, Glenlyon was supping and playing at cards with those whom he meant to assassinate before dawn. At five the murderous work began. Before dawn of day 38 corpses were lying about the village in their blood. Hamilton on account of not coming up in time let about 300 escape and when he arrived and found the work so imperfectly done, he seized an old man above seventy, whom the other butchers agreed to let live, and murdered him in cold blood. The scene of the massacre is visited annually by tourists, who are accommodated with conveyances in connection with Hutcheson's steam-vessels from Glasgow.

ED. RYNEARSON.

951. Over how many degrees of latitude does the sun cast vertical rays at any one time.

C. H. B.

Ans.—The mean apparent diameter of the sun is about 32' in round numbers; hence the sun may cast vertical rays on about half a degree of latitude at any one time.

EDITOR.

952. What state refrained from voting for Lee's famous resolutions? Why?

S.

Ans.—The delegates from New York had no instructions from their province, and therefore refrained from voting for Lee's famous resolutions, which were proposed June 7, and adopted by the other twelve colonies in Congress, July 2, 1776.

ED. RYNEARSON.

953. What causes equinoctial storms?

L. M. O.

Ans.—The so-called equinoctial storms are unfounded, as there is no connection whatever between the equinoxes and the storms at that time. Meteorologists have so decided.

EDITOR.

954. Why is Persia called the *Peacock Throne* and a certain president the *Cincinnatus of the West*?

Id.

Ans.—It was built during the reign of Shah Jehan, the sovereign of India. It was resplendent with diamonds, which are said to have cost \$30,000,000, and took its name from its principal ornament, a peacock with a spreading tail, the colors of which were represented by different kinds of precious stones. It was afterwards taken from Mohammed Shah, the son of Gehandur, the Mogul emperor of India, in the year 1736, by Nadir Shah, the emperor of Persia, with other treasures from Dehhi, capital of Mohammed Shah. See *Scam's New and Complete History of China and India*.

L. M. ORLADY.

William Henry Harrison was called the *Cincinnatus of the West* because he represented Cincinnati in Congress in 1817-18, and was also a member of the order of Cincinnati.

EDITOR.

955. Give an account of the reverse of the great seal of the U. S.

Ans.—Benj. Franklin, John Adams and Thos. Jefferson were appointed on the afternoon of Independence day to prepare a device for a seal. They failed and so did the committees of 1779 and 1782. But while John Adams was in London, 1782, negotiating for peace, Sir John Prestwitch, a well-known English antiquarian, gave him a device, which he forwarded to Mr. Thompson, Secretary of Congress, and it was adopted June 20, 1782. The design is as follows:

A spread eagle, bearing on its breast our national shield without supporters, as emblematic of self-reliance; in its beak a scroll, with the words *E Pluribus Unum*, one government composed of many states; in its right talon an olive branch, a symbol of peace, and in its left a bundle of 13 arrows, a symbol of the U. S. and of war; the crest, a glory breaking through a cloud, and surrounding a cluster of stars, forming a constellation.

The design for the reverse was included, which consisted of an unfinished pyramid, signifying strength and progress; above it an eye within a triangle surrounded with a glory and capped with the words *Annuit Cœptis* (He favors

our endeavors) which represents the all-seeing eye of a protecting and overruling Providence, and on the base of the pyramid, MDCCCLXXVI., with the motto *Novus ordo Seclorum*. The reverse of the seal has never been used.

EDITOR.

956. What is the latest supposed formation of a meteor? *Id.*

Ans.—Meteoric science is a structure erected stone by stone by many builders, and it is difficult to find whence the last contribution has come.

EDITOR.

A writer in the *Quarterly Review* thus sums up the result of all the chemical analyses hitherto made: "We find the actual number of recognized aerolites to be 19 or 20—that is, about one-third of the whole number of elementary substances discovered on the earth. Further, all these aerolitic elements actually exist in the earth, though never similarly combined there. No new substance has hitherto come to us from without; and the most abundant of our terrestrial metals, iron, is that which is largely predominant in aerolites, forming frequently, as in some of the instances just mentioned, upwards of 90%. Seven other metals—copper, tin, nickel, cobalt, chrome, manganese and molybdena—enter into the composition of these stones. Cobalt and nickel are the most invariably present, but the proportion of all is trifling compared with that of iron. Further, there have been found in different aerolites six alkalies and earths—namely, soda, potash, magnesia, lime and alumina; and in addition to these carbon, sulphur, phosphorus and hydrogen. Finally, oxygen must also be named as a constituent of many aerolites, entering into the composition of several of the substances just mentioned. As respects the manner of conjunction of these elements, it is exceedingly various in different aerolites. A few there are, especially examined by Berzelius and Rose, containing alivine, angite, hornblende, and other earthy minerals, and closely resembling certain crystalline compounds which we find on the surface of the earth."

L. M. ORLADY.

957. What was the Astrolabe used by Columbus? *G. L. S.*

Ans.—The word *astrolabe* is taken from two Greek words, signifying to *take the stars*, and was applied to circular, graduated rings with sights for taking altitudes at sea. The astrolabe has been superseded by the more perfect instruments of modern astronomy.

ED. RYNEARSON.

The astrolabe was invented to ascertain the position of the sun with regard to the ecliptic.—*Whewell*.

EDITOR.

958. Who is the author of

"Wisdom and justice many men admire;
Jarring vice harms truth's pure, trembling fire;
Pray be loyal, just; go! highest good acquire."

L. A. M.

COMMENT.—Our querist, Dr. Mathias, informs us that he saw those lines in a scrap-book, and that they were clipped from an eastern school journal. The editor said, "These lines from one of the old masters contain twenty-one words. The remarkable thing about them, however, is that the initial letters of the words are the initial letters of the presidents in regular order." This "remarkable thing" gives them peculiar interest, and we should like to have the name of the "old master" who wrote them.

EDITOR.

959. "If, when fully charged with vapor, the air is suddenly cooled, part of the vapor is thrown off."—*Appleton's Geography*. How does the air become suddenly cooled? *J. A. S.*

Ans.—By the accumulation of electricity, which in its equalized and slumbering state is cold and invisible, capable of producing such coldness as to freeze rain into hailstones of great size. This wonderful, eternal substance pervades the whole frame of nature, and were it not for the heat from the sun, the crust of the earth would soon be a solid mass of frozen matter. Yet, by

the inconceivable rapidity with which it moves, the friction on other particles of matter produces light and heat.

EDITOR.

960. Can the President and Vice President be elected from the same state? Explain.

C. A. S.

ANS.—They can not, because the 14th Amendment to the Constitution says, "The Electors shall meet in their respective states and vote by ballot for President and Vice President, one of whom, at least, shall not be an inhabitant of the same state with themselves."

LAWRENCE DUNLAP.

961. Give a history of the man who said, "Give me a place to stand and I will move the world."

J. D. BEARD.

ANS.—Archimedes, the greatest mathematician and most inventive genius of antiquity, was born at Syracuse, Sicily, about 287 B. C., and was of Greek extraction. He was the devoted friend of Hiero, king of Syracuse, and exercised his ingenuity in the service of his admirer and patron. While pondering on the method of detecting the artificer's fraud in making Hiero's golden crown, he immersed himself in a full bathing-tub, and observing the water running over, it occurred to him that the excess of bulk occasioned by the alloy could be found by putting the crown and an equal weight of gold separately into a vessel filled with water. He was so transported with joy on this discovery that he ran home without his clothes, exclaiming, *Eureka*—I have found it. He was profoundly versed in mechanics and hydrostatics, as well as in geometry, inventing many useful machines and contrivances. His life ended with the capture of Syracuse by Marcellus in 212 B. C. In the general massacre that followed the fall of the city, Archimedes, while drawing a mathematical figure in the sand, was run through the body by a Roman soldier, contrary to the orders of Marcellus, who had commanded his men to spare this sage. An honorable burial took place, and in accordance with the expressed wish of the philosopher, his tomb was marked by the figure of a sphere inscribed in a cylinder—the discovery of the relation between their volumes being regarded by him as his most valuable achievement.

EDITOR.

962. Describe the *House-Tax Insurrection*.

A. F. P.

ANS.—In 1799 an insurrection occurred in some of the counties of Pennsylvania against the levying of the direct tax upon houses. In the village of Bethlehem the troubles took the form of an armed resistance to the assessors, by about fifty men, led by a man named Fries. A large number of them were afterwards arrested, and Fries was found guilty of treason. For some technical reason a new trial was granted on which he was again found guilty, but President Adams soon pardoned him.

A. F. PRAKEL.

963. What was the *Bridge-Building Brotherhood*?

Id.

ANS.—It was a religious society that originated in Southern France in the latter part of the 12th century. Their purpose was to build bridges, keep up ferries, etc. The church during the middle ages regarded the making of streets and bridges as meritorious religious services. The fraternity was sanctioned by Pope Clemens III. in 1189. Its internal organization was similar to that of the knightly orders, and the members wore on their breast as a badge or insignia, a pick hammer.

W. J. KAUFFMAN.

964. What were the last words of Henry Clay?

ANS.—According to a letter from his son, Thos. H. Clay, just before his death the dying man said: "My son, I believe I am going;" and presently asked him to "button his shirt collar." He died in a short time after this. See *Cincinnati Commercial Gazette*, Vol. 90, No. 9.

B. S. DAVIS, *Gordon, Ohio.*

965. What was the inscription on Mrs. A. Lincoln's wedding ring, and what became of it?

ANS.—The inscription was, "A. L. to Mary, Nov. 4, 1842. Love is eternal." The ring was buried with her at Springfield.

B. S. DAVIS.

List of Contributors to this Number.

- WM. J. KAUFFMAN, *Marshallville, Ohio*, 943, 944, 962.
 GEO. L. SHANER, *Stewart's Station, Pa.*, 957.
 B. F. FINKEL, *Amanda, Ohio*, 945.
 JOHN KNIESLY, *Gettysburg, Ohio*, 943, 945, 957.
 ED. RYNEARSON, *Gettysburg, Ohio*, 943, 944, 945, 947, 950, 952, 957.
 M. W. HOLLINGER, *Hill Grove, Ohio*, 943, 947, 950.
 LAWRENCE DUNLAP, *Zanesfield, Ohio*, 943, 960.
 S. B. KECKLER, *Weaver's, Ohio*, 944, 950.
 J. D. BEARD, *Pyrmont, Ohio*, 944, 957, 962.
 L. M. ORLADY, *McConnellstown, Pa.*, 954, 956.
 A. L. MENDENHALL, *West Manchester, Ohio*, 957.
 A. F. PRAKEL, *Versailles, Ohio*, 961.
Querists—L. P. KUHN, *Strasburg, Ohio*; PROF. H. A. WOOD, *Cleveland, Ohio*; G. W. SCHAEFFER, *Arcanum, Ohio*; J. R. BALDWIN, *Blue Grass, Iowa*.

QUERIES.

990. Trace the International Date-Line, as it now exists. L. G. KUHN.
 991. When and by whom was the Type-Revolving Press invented? *Id.*
 992. In whose reign was the "Parliament of Paris" established? H. A. WOOD.
 993. When was the silk worm introduced into Europe? *Id.*
 994. Name the seven wise men of Greece. G. W. SCHAEFFER.
 995. How was coal discovered? *Id.*
 996. Locate four post-offices, whose names contain two letters each. *Id.*
 997. Name some standard authors on Physiognomy. On Mesmerism? W. C. L.
 998. Explain meaning of italicized words, used by Rose Cleveland and taken from the *Normal Monthly*: "In these days of ebb and quicksand, when aghosticism rears its stone-wall in front of faith, and writes upon it in black letters, *the end-all and the be-all of all knowing, the unknowable*, we have need to go where God is to confirm our faith in Him." J. R. BALDWIN.
 999. Who have written under the following pseudonyms: Eli Perkins, Gath, Peter Pindar, Sam Slick and Teufelsdröckh? D. W. K.
 1000. Give the names of the "Pilgrim Fathers" that came in the *Mayflower*. A. P. PRAKEL.
 1001. Give a sketch of Parker Cleaveland, *Id.*
 1002. What noted statesman and infidel said that the Bible is the germ of musk which has perfumed all Europe? B. S. D.
 1003. What meridians has Congress adopted for nautical and astronomical purposes? B. F. FINKEL.
 1004. Explain why a plumb-line, if prolonged, would not pass through the center of the earth, except at the equator or poles. M. C.
 1005. Locate the national homes for U. S. soldiers and sailors.
 Answers should be received on or before Aug. 10.



EDITED BY

JOHN S. ROYER.

VOL. VII.

AUGUST, 1886.

No. 8.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

813. A beat B by 80 ft. in a foot race, but if A had walked $\frac{8}{9}$ of his rate and B $\frac{9}{10}$ of his, A would have beaten B by 26 ft. How far did they walk?

By J. K. ELLWOOD, *Mauch Chunk, Pa.*

Solution in Jan. No., p. 1, is not correct. A, being the more rapid walker, determines the *time* of the race. $\therefore$ 2d running time was $\frac{9}{8}$ of the 1st, and $\frac{9}{8} \times \frac{9}{10} = \frac{81}{80}$ of B's first distance. B then gains $\frac{1}{80}$ of his 1st run, or 54 ft., and $54 \times 80 = 4320$ ft., B's first run, which added to 80, makes 4400 ft., the course.

By J. C. GREGG, *Brazil, Ind.*

Let x = A's distance, and $x-80$, B's. The time of the 2d running will be $\frac{9}{8}$ of the first. Hence $\frac{81}{80}(x-80)$ = distance B runs the second time, and $x - \frac{81}{80}(x-80) = 26$; whence $x = 4400$, *Ans.*

896. The population of a city is 2,000,000. If births and immigration increase the number 2%, and death and emigration decrease it $1\frac{3}{4}\%$, annually, what will be the population in 150 years?

A. M. SCRIPTURE.

By A. L. FOOTE, *Merrick, N. Y.*

Let $P = 2,000,000$, the present population, $n = 150$, the number of years, A = the number at the end of n years, and let $a = [1 + (1 \div r)] = 1 + (2\% - 1\frac{3}{4}\%) = \frac{301}{300}$, and we have $A = P \times a^n$; or in logarithms, $\log A = n \times \log \frac{301}{300} + \log 2,000,000$, or $\log A = 150(\log 301 - \log 300) + \log 2,000,000$. Using 12-figure logarithms, we find

$$\log A = 6.517816126764;$$

whence $A = 3,294,778$, population at end of 150 years.

897. What is the price per dozen of eggs, when, to give 3 more for 20 cents, would reduce the price per dozen $1\frac{1}{2}$ cents? D. W. K. MARTIN.

By A. M. SCRIPTURE, *Clinton, N. Y.*

Let x = price per dozen. Then $\frac{1}{12}x$ = price of each egg, and $20 \div \frac{1}{12}x$, or $240 \div x$ = number bought for 20¢. Hence

$$20 \div [(240 \div x) + 3] = (x - 1\frac{1}{2}) \div 12,$$

which reduces to $9x^2 - 15x = 1200$; whence $x = 12.41037$ cents.

REMARK.—If $2\frac{1}{2}$ be taken instead of $1\frac{1}{2}$, the result will be an integral number (16 cents).

898. Three men, named Adams, Brown and Clark, with their sons Daniel, Edward and Francis, have each a piece of land in the form of a square. Mr. Adams's piece is 23 rods longer on each side than Edward's, and Mr. Brown's piece is 11 rods longer on each side than Daniel's. Each man has 63 sq. rd. more than his son. Which of these persons are father and son, respectively?

B. F. FINKEL.

By PROF. COOPER D. SCHMITT, *Charlottesville, Va.*

Let A, B, C, D, E and F stand for the names of which they are the initials. Then by the conditions we have $A = E + 23 \dots (1)$, and $B = D + 11 \dots (2)$. Also, $D^2 + 63, E^2 + 63$, and $F^2 + 63$ must each be a perfect square. Examining a table of squares, we find that the only squares whose difference is 63, are 1 and 64, 81 and 144, and 961 and 1024. Hence D, E and F must be 1, 9 and 31, and A, B , and C , 8, 12 and 32. Hence to satisfy (1), $A = 32$ and $E = 9$; to satisfy (2), $B = 12$ and $D = 1$. It is now easily seen that A and F are father and son; likewise B and E , and C and D .

By GEO. C. RUSSELL, *Petaluma, Cal.*

Let x^2 be the general expression for the area of a son's lot and $(x+m)^2$ for that of a father's. Then $(x+m)^2 - x^2 = 2mx + m^2 = 63$, and $x = (63 - m^2) \div 2m$. When m is 1, $x = 31$; when m is 3, $x = 9$; and when m is 7, $x = 1$. Hence, the side of one son's lot is 31 rd. and the side of his father's is $31 + 1 = 32$ rd.; the side of another son's is 9 rd. and the side of his father's is $9 + 3 = 12$ rd.; and the side of the other son's lot is 1 rd. and that of his father's $1 + 7 = 8$ rd.

As $12 - 1 = 11$ rd., Mr. Brown's lot must be 12 rds. square and Daniel's 1 rd. As $32 - 9 = 23$ rd., Mr. Adams's lot is 32 rd. square and Edward's 9 rd. Mr. Clark's must then be 8 rd. square, and Francis's 31 rd. The owners of the 12-rod and the 9-rod lot are father and son, and the son's name is Edward Brown. Likewise Francis Adams is another son, for the owners of the 32-rod and the 31-rod lots bear the relation of father and son. Evidently, the name of the other is Daniel Clark.

899. Victor was riding with his father through the country. They stopped to rest under the shade of a tree. A village lay directly north of them and another directly east. After leaving the tree they rode 30 miles in a course 35° east of north, and then were equidistant from the two villages. After riding 15 miles farther in the same direction, they were in a direct line with the villages. Now Victor is a young mathematician and wishes to know how many contributors to the *Visitor* can tell him how far apart the two villages are, and how far from each they were when under the tree. H. A. Wood.

By D. S. POND, Rochester, Ohio.

Let A be the place where they rested, B the north and E the east village, C the point in their course equidistant from the two villages and D the final point. F and H are points in the line AB and due west of C and D , respectively. Also G and I in the line AE and due south of C and D , respectively. The road ACD is $N. 35^\circ E.$, and $CF = 30 \times \sin 35^\circ = 17.2074$ miles, and $CG = 30 \times \sin 55^\circ = 24.5754$ miles. $17.2074 \div \sin ABC = 24.5754 \div \sin AEC = BC = CE = 46.455$ miles. $\cos AEC \times CE = EG = 39.42$ mi.; $\therefore AE = 39.42 + 17.2074 = 56.63$ mi., distance to east village from the tree. $\cos ABC \times BC = BF = 43.15$ mi., and $AB = 43.15 + 24.5754 = 67.72$ mi., to north village. Similarly, $DH = 45 \sin 35^\circ = 25.8111$ mi., $DI = 45 \sin 55^\circ = 36.86175$. Hence $EI = AE - DH = 56.63 - 25.8111 = 30.8189$ mi.; $DE = \sqrt{(EI^2 + DI^2)} = 48.04764$ mi. and $BD = \sqrt{(DH^2 + BH^2)} = 40.233867$ mi.; therefore, $BE = 48.04764 + 40.23386 = 88.2815$ mi., distance villages are apart.

By D. H. DAVISON, Minonk, Ill.

Put $a = 30$ mi., $b = 45$ mi.; $s = .5735764$ sine, and $c = .819152$ cosine of $< 35^\circ$. Let x = miles from tree to north village, and y = miles to east village; then

$$y : x :: bs : x - bc \dots (1), \quad (y - as^2) + a^2c^2 = (x - ac)^2 + a^2s^2 \dots (2),$$

$$y^2 - 2asy = x^2 - 2acx \dots (3) = (2).$$

From (1) we find $y = bsx \div (x - bc)$; $\therefore y^2 = b^2s^2x^2 \div (x^2 - 2bcx + b^2c^2)$. Substituting these values of y and y^2 in (3), we have

$$\frac{b^2s^2x^2}{x^2 - 2bcx + b^2c^2} - \frac{2abs^2x}{x - bc} = x^2 - 2acx \dots (4).$$

By trigonometry $s^2 + c^2 = 1$, hence $s^2 = 1 - c^2$. Substituting this value of s^2 in (4), dividing each term by x , clearing of fractions, condensing and arranging terms, we have the general formula

$$x^3 - 2c(a+b)x^2 + b[(a+b)2c^2 + 2a - b]x = 2ab^2c.$$

Restoring the values of a , b , and c , we have

$$x^3 - 122.8728x^2 + 5204.3175x = 99526.968,$$

from which $x = 67.72915$, and by substitution $y = 56.63444$; $\sqrt{(x^2 + y^2)} = 88.28985$ mi., the villages are apart.

900. James Evans has a field in the form of a trapezoid; the north and south sides are 20 and 40 chains in length. The distance from the southeast corner to the northwest corner is 70 chains; from the southwest corner to the northeast corner is 60 chains. From these data determine the area of the field.

J. W. PFEIFFER.

By B. F. FINKEL, *Amanda, O.*, and WM. WILEY, *Detroit, Mich.*

Prolong the north side until it meets the perpendicular to the south side from the southeast corner. Let y = the prolongation, and x = the perpendicular. Then

$$(20+y)^2+x^2=70^2 \dots (1) \text{ and } (40-y)^2+x^2=60^2 \dots (2).$$

Subtracting (2) from (1), $120y = 2500$; whence $y = 20\frac{5}{6}$ chains. By substitution, $x = \frac{1}{6}\sqrt{116375}$. Area is the product of half the sum of the parallel sides by the perpendicular; or $\frac{1}{2}(20+40) \times \frac{1}{6}\sqrt{116375} \div 10 = 170.5688$ acres.

By W. C. BINKLEY, *Cincinnati, Ohio.*

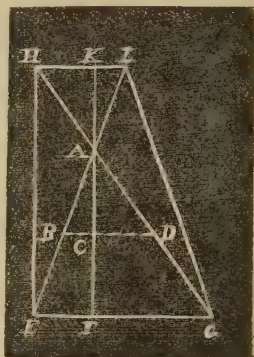
Since HL and EG are parallel, the alternate interior $\angle$ s HLE and LEG are equal, and one will fit upon the other; and as $HL = \frac{1}{2}EG$, the perpendicular AK of the $\triangle AHL$ is half the perpendicular AF of the $\triangle AEG$.

Draw BD parallel to HL , making $AC = AK$; then $BD = HL$, $AB = AL$, $AD = AH$. Now, $AB + BE = 60$ and $AD + AG = 70$. As $AC = \frac{1}{2}AF$, $AB = \frac{1}{2}AE$ and $AD = \frac{1}{2}AG$; from which $AB = 20$, $AE = 40$, $AD = 23\frac{1}{3}$, and $AG = 46\frac{2}{3}$. By Geometry

$$EG : EA + AG :: AG - EA : FG - EF.$$

Or $40 : 86\frac{2}{3} :: 6\frac{2}{3} : (FG - EF = 14\frac{4}{9})$; whence $EF = 12\frac{7}{9}$ and $FG = 27\frac{2}{9}$; $AF = \sqrt{(AE^2 - EF^2)} = 37.904$ ch., and $KF = 37.904 + 18.952 = 56.856$ ch. Hence $56.856 \times \frac{1}{2}(20+40) = 1705.68$ sq. ch. or 170.568 A.

NOTE.—Our engraver failed to make the cut for this solution. The Editor was obliged to cut it himself, or suspend work for a week.



901. Suppose a fly lights on the spoke of a carriage wheel 5 feet in diameter, 6 inches up from the ground. What distance will the fly move while the wheel makes one revolution on a level plane?

By S. G. CAGWIN, *New London, N. Y.*

Let O be the center of the wheel in any of its positions, α its radius, φ the angle through which the spoke OM has moved since M , the extremity on which the fly rests, was in contact with the plane at A . Put $OF = b$, the distance of the fly from the center of the wheel, and let x and y be the rectangular co-ordinates of F , A being the origin and the axis of x co-inciding with the plane. Then

$$y=a-b\cos\varphi, x=a\varphi-b\sin\varphi, \text{ and } dy=b\sin\varphi d\varphi.$$

$$dx=(a-b\cos\varphi)d\varphi, \text{ and } \sqrt{(dy)^2+(dx)^2}=\sqrt{(a^2+b^2-2ab\cos\varphi)d\varphi}.$$

Let S = the number of feet the fly moved while the wheel makes one revolution; then, since $a=2\frac{1}{2}$ and $b=2$, we have

$$S = \int_0^\pi \sqrt{(a^2+b^2-2ab\cos\varphi)d\varphi} = \int_0^\pi \sqrt{(41-40\cos\varphi)d\varphi}.$$

$$\text{Put } \varphi=2\theta; \text{ then } S=18 \int_0^{\frac{1}{2}\pi} \sqrt{(1-\frac{8}{5}\cos^2\theta)d\theta} =$$

$$9\pi \left\{ 1 - \frac{20}{81} - 3\left(\frac{1}{1.2}\right)^2\left(\frac{20}{81}\right)^2 - 5\left(\frac{1.3}{1.2.3}\right)^2\left(\frac{20}{81}\right)^3 - 7\left(\frac{1.3.5}{1.2.3.4}\right)\left(\frac{20}{81}\right)^4 \right\} \\ = 18.84 \text{ ft.}$$

902. Suppose a hemispherical vessel 3 feet in diameter were filled with water, and that ice could freeze uniformly 5 in. thick on top and on the inner surface of the vessel, what would be the volume of ice thus formed? EDITOR.

By J. K. ELLWOOD, *Mauch Chunk, Pa.*

Let NMA be a vertical section of vessel, EFC the water not frozen, and OH the thickness of the ice. Volume of hemisphere is 7.0686 cu. ft. The water not frozen forms a segment of a sphere whose height is $HC=18-10=8$ in. $=h$ and the radius of the sphere is $18-5=13$ in. $=OC=R$. The volume of a spherical segment of one base, as EFC , is $\pi h^2(R-\frac{1}{3}h)$.

Substituting in this formula the values of h and R , we find volume of segment to be 1.20234 cu. ft. Then $7.0686-1.20234=5.86626$ cu. ft., volume of ice formed.

By WM. KAUFFMAN, *Marshallville, Ohio.*

Solidity of vessel is $(36^3 \times .5236) \div 2 = 12214.54$ cu. in. Now when the ice freezes, the water inside forms a spherical segment the base of which is $\sqrt{(13^2-5^2)} \times 2 = 24$ in., and height $18-10$, or 8 in. Then $\frac{1}{2}(12^2 \times \pi \times 8) + 8^3 \times \frac{1}{6}\pi = 2077.64$ cu. in., solidity of segment, and the ice occupies $12214.54 - 2077.64 = 10136.9$ cu. in. or $5.86 +$ cu. ft.

903. From a circular farm of 270 acres, a father gives to his sons equal circular farms, touching each other and the boundary of the farm. He takes for himself a circular portion in the center, equal in area to a son's part, and reserves the vacant tracts around his part for pasture lands and gives each son one of the equal spaces left along the boundary. Required, the number of sons and the amount of pasture land each has. *Id.*



By W. J. HUSSEY, Mendon, Ohio.

Let C be the center of the father's farm, A and B the centers of two adjoining farms of two sons, E and F the points where these farms are tangent to the original farm, and D where they are tangent to each other.

Now ABC is an equilateral triangle, and as six such triangles may be arranged around a point ($360 \div 60 = 6$), there will be six farms for the sons; hence six sons. Since the radii of the original farm and those of the sons' farms are as 3 to 1, their areas are as 3^2 to 1^2 , or as 9 to 1, and each new farm contains $270 \div 9 = 30$ acres. Since AEF contains $\frac{1}{6}$ of $270 = 45$ acres, the two triangular areas included have $45 - (15 + 15 + 5) = 10$ acres.

We find $CE = \sqrt{(270 \times 160 \div \pi)} = 117.34$ rds., and $AC = \frac{2}{3}$ of $117.34 = 78.226$ rds., from which the area of $ABC = 16.54$ acres. Then $6(16.54 - 15) = 9.24$ acres, pasturage belonging to the father's farm, and $10 - 1.54 = 8.46$ acres, pasturage belonging to each son.

By C. W. THOMPSON, Kansas City, Mo.

Let the farms be arranged as in the figure above. It can then be proven by Geometry :

1st, That each son's farm is a circle inscribed in one of the equilateral triangles which form a regular hexagon circumscribing the large circle or original farm.

2d, That the radius of each small circle equals $\frac{1}{3}$ of the radius of the large circle.

3d, That the areas of circles are to each other as the squares of their radii.

Hence it follows that there are six sons; that each smaller circle contains $270 \div 9 = 30$ acres; and that the hexagon, side AB , contains 99.23527 acres. Now the farming land within the hexagon equals the father's plus 6 times $\frac{1}{3}$ of each son's, or 90 acres. The father's pasture land is $99.23527 - 90 = 9.23527$ acres. The farming land without the hexagon is 6 times $\frac{2}{3}$ of each son's, or 120 acres. Hence the pasture land "along the boundary" is $270 - (120 + 99.23527) = 50.76473$ acres, and each son pastures $50.76473 \div 6 = 8.46079$ acres.

NOTE.—Mr. Parsons' solution of Prob. 899 was selected, but our engraver being sick, failed to furnish the necessary cut, and its publication is deferred. The solutions in this issue will prove very interesting to the careful reader.



The Algebraical Determination of the Constant π .By HENRY GUNDEr, *New Castle, Ind.*

Let e = base of natural logarithms and let x = any variable; then it is shown by Algebra that

$$e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^4}{4} \dots (1).$$

Let $F(x)$ and $f(x)$ be two functions of x , such that

$$f(x) = \frac{1}{2}(e^{xi} + e^{-xi}) \dots (2) \quad \text{and} \quad F(x) = \frac{1}{2i}(e^{xi} - e^{-xi}) \dots (3),$$

where $xi = x\sqrt{-1}$.

In these functions the following remarkable properties hold: Put $-x$ for x ; then

$$f(-x) = f(x) \dots (a), \quad F(-x) = -F(x) \dots (b), \quad f(0) = +1 \dots (c),$$

$$\text{and } F(0) = 0 \dots (d). \quad \text{Also, } [f(x)]^2 + [F(x)]^2 = 1 \dots (4).$$

In (4), when $F(x) = 0$, $f(x) = \pm 1 \dots (e)$. But from (c) and (d) it appears $F(0)$ gives $f(x) = +1$, only; hence $f(x)$ must be -1 for some other value of x different from 0. Let this value be represented by P , so that $F(P) = 0$ and $f(P) = -1$.

Now, in (2) and (3), write y for x , and form the two following very important relations:

$$f(y)f(x) + F(y)F(x) = f(y-x) \dots (5),$$

$$F(y)f(x) - f(y)F(x) = F(y-x) \dots (6).$$

In (5) and (6) write P for y , and these equations take the following forms: $f(P-x) = -f(x) \dots (7)$ and $F(P-x) = +F(x) \dots (8)$.

Equation (8) shows $F(x)$ to have same sign for all values of x between 0 and P , inclusive, while (7) shows $f(x)$ to change sign between those values; i. e., this function passes through 0 for some value of x between P and 0. To find this value note that $F(x)$ has equal values for values of x equally removed from 0 and P , or what is the same thing, for values equally distant from $\frac{1}{2}P$. Put $\frac{1}{2}P$ for x in (7) and (8), then $f(\frac{1}{2}P) = -f(\frac{1}{2}P)$; or $f(\frac{1}{2}P) = 0$, and then $F(\frac{1}{2}P) = +1$.

Now put $\frac{3}{2}P$ for x in (7) and (8), and $f(\frac{3}{2}P) = -f(\frac{1}{2}P) = 0$, and $F(\frac{3}{2}P) = -F(\frac{1}{2}P) = -1$. Then is established these facts: $f(\pm\frac{1}{2}P) = 0$, $f(\pm\frac{3}{2}P) = 0$, and so on for any odd multiple of $\pm\frac{1}{2}P$.

Now expand the exponentials in (2) by (1), and there results

$$f(x) = 1 - \frac{x^2}{2} + \frac{x^4}{4} - \frac{x^6}{6} \dots (9).$$

But (9) vanishes for every odd multiple of $\pm\frac{1}{2}P$ by the preceding investigation; so also does the expression

$$\left(1 - \frac{4x^2}{P^2}\right)\left(1 - \frac{4x^2}{9P^2}\right)\left(1 - \frac{4x^2}{25P^2}\right) \dots\dots\dots$$

Therefore we may write

$$1 - \frac{x^2}{2} + \frac{x^4}{4} - \dots = \left(1 - \frac{4x^2}{P^2}\right)\left(1 - \frac{4x^2}{9P^2}\right) \dots\dots (10).$$

Expanding 2d member of (10), the co-efficient of x^2 is seen to be

$$\frac{4}{P^2}\left(1 + \frac{1}{3^2} + \frac{1}{5^2} + \dots\right),$$

which must equal the co-efficient of x^2 in first member; hence

$$\frac{1}{2} = (4 \div P^2)\left(1 + \frac{1}{9} + \frac{1}{25} + \frac{1}{49} + \dots\right) \dots\dots (11).$$

Whence, by approximation, we find $P = 3.14159+$. Therefore $P = \pi$. Thus the natural constant π is found without the aid of Geometry or Trigonometry. It is scarcely necessary to remark that $F(x) = \sin x$, and that $f(x) = \cos x$.

From these equations the whole science of Trigonometry may be evolved. Further, every number has a sine and a cosine, and these important functions are functions of numbers and not of lines, as usually taught in elementary books. These considerations and the series involved in (1), (2) and (3), may be made the basis of an entirely different method of presenting certain branches of mathematics, which have been, and are now taught, to the student by what may be called the historical method. The method proposed in this paper may be designated the *Scientific Method*. It was outlined about half a century ago by Prof. J. J. Littrow, of Berlin, but was never introduced by teachers, at least not to the knowledge of the writer. Had the exponentials in (3) instead of (2) been expanded by (1), we should have found

$$\frac{1}{6} = (1 \div P^2)\left(1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \dots\right), \text{ or } \frac{1}{6}\pi^2 = 1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \dots,$$

which is one of the forms of John Bernoulli asked for in a recent problem of the *Visitor*.

NOTE.—Mr. Gunder is returning to the schoolroom again, which is as it ought to be. He is an excellent teacher and will have charge of the schools at North Manchester, Wabash Co., Ind. He is one of the instructors for the Institute at Wabash in August. His paper in this number is new and full of merit. The reasoning is sound but somewhat abstruse; yet a good knowledge of algebra will carry any one through it without any difficulty. He has been asked by several readers of the *Visitor* to give instructions in the Calculus. Let us have an expression of our mathematical friends in regard to a series of instructive papers from him on that subject in the *Visitor*. He could give explanations and exercises that would enable the private student to acquire a fair knowledge of that transcendent and beautiful branch of Analysis.

HENRY GUNDER solved all except 898. B. F. FINKEL solved all. A. F. PARSONS, *Arroyo Grande, Cal.*, solved all. JOHN F. FROBE, *Versailles, O.*, 892, 903. R. A. LEISY, *Burton City, Ohio*, 892-3-4-7-8, 902-3. ALBERT DAVISON, *W. Newton, O.*, 892-8, 900. J. E. GENSEMER, *Marshallville, O.*, 892-3-4, 902-3. T. L. BREWER, *Mt. Heron, Ohio*, 892, 903. W. C. BINKLEY, *Cincinnati, O.*, 892-3, 900-2-3. W. J. KAUFFMAN, 892-3-4, 902, 3. S. B. KECKLER, *Weaver's, Ohio*, 892-3. C. W. THOMPSON, 892-3-6-7-9, 900-2. A. L. FOOTE, 892-3-4-6-7-8-9, 902-3. W. J. HUSSEY, 892, 3-6-7, 900-2-3. D. S. POND, 892-3-7, 902-3. WM. WILEY, 892-6-7-9, 900-2. GEO. C. RUSSELL, 892-3-7-8, 900-3. COOPER D. SCHMITT, 892-4-6-7-8, 901-2. A. M. SCRIPTURE, 896-7-8, 902-3. J. K. ELLWOOD, 896-7, 900-1-2-3. J. C. GREGG, 901.

Problems for Solution.

911. Equal weights of gold and silver are in value as 20 to 1, and equal volumes are in value as 1284 and 35. A certain volume is composed of equal weights of gold and silver. Find how many times more valuable the same volume would be were it composed of gold. J. A. ROACH, *Frontenac, Minn.*

912. A delivered daily for a period of 42 days 4 letters more than on the previous day. The aggregate delivery for the last 18 days was the same as that for the first 24 days. How many letters did he deliver altogether? *Id.*

913. A sold goods which cost him \$300 to B at a certain rate of profit. B sold the goods to C at the same rate of profit. If C paid \$432 for the goods, what did B pay? *Id.*

914. A wins 9 games out of 15 when playing against B, and 16 out of 25 when playing against C. How many games out of 118 should C win when playing against B? *Id.*

915. A tinner makes two similar rectangular oil cans whose inside dimensions are as 3, 7 and 11. The first holds 8 gallons and the second being larger requires four times as much tin as the other. What are the dimensions of the smaller and the contents of the larger? N. O. SMITH.

916. A cylindrical vessel one foot in diameter was $\frac{1}{2}$ full of water, and by dropping a ball into it the water rose to the brim; find solidity of ball. *Id.*

917. An agent sold flour for me. After deducting his commission, he invested the proceeds in bank stock at 4% discount. After selling the stock at 30% premium, he remitted balance due me, charging 4% commission in each transaction. What was my rate of gain on value of flour?

918. My agent sold corn at 2 $\frac{1}{2}$ % commission. After increasing the proceeds by \$8.20, I ordered him to purchase wheat at the same commission; after which wheat declining 5%, my whole loss was \$48. What was the value of the corn? *By Request.*

919. A tailor bought 40 yd. of broadcloth 2 $\frac{1}{4}$ yd. wide. After sponging, it shrank 3 $\frac{1}{4}$ % in length and 6 $\frac{1}{4}$ % in width. He desires to know how many yards of flannel 1 $\frac{1}{4}$ yd. wide he must buy to line the broadcloth, provided the flannel will shrink 6 $\frac{1}{4}$ % in length and 2 $\frac{1}{4}$ % in width. *Id.*

920. A man pulls out the stumps in a field at the rate of 25 cents a piece and piles up the stones at 10 cents a score. One stump occupies him as long as 40 stones. He works 3 days and earns \$8, then goes on at the same rate of working and finishes the job in 3 $\frac{1}{4}$ days more, earning altogether \$20. How many stumps and stones were there in the field? EDITOR.

921. If A walk 9 hr. a day and B 8 hr. a day, and if, under like conditions, B walks 20% faster than A, how many days can A walk down hill a distance which B accomplished up hill in 5 days; supposing a man's rate is increased by $\frac{1}{3}$ in going down hill and decreased $\frac{1}{3}$ in going up? *Id.*

922. From an elevator wheat is running upon a floor at a uniform rate. After a certain quantity is on the floor, six men go to work and clear it in an hr.; but if ten men had been employed, the floor could have been cleared in half an hour. How long would it take four men? *Id.*

Solutions should be received on or before Sept. 4. Biographical sketches of contributors who will solve all these problems will be published in the *Visitor*, except those already given. Let us have your best efforts.

Examination Questions.

Used at Greenville, at the special examination, July 24. Next is to be held Aug. 7. Tell your friends to subscribe for the *Visitor*.

ARITHMETIC.

1. Define Arithmetic, Mathematics, Science, Ratio, Axiom.

ANS.—SCIENCE in its general sense signifies knowledge reduced to order; that is, knowledge so classified and arranged as to be easily remembered, readily referred to, and advantageously applied. More strictly speaking, it is a knowledge of laws, principles, and relations. Pure science is based on self-evident truths, and laws of relation are deduced by demonstration—of this nature is mathematical science. Natural science is based upon experiment and observation, and its fundamental laws are deduced by inductive reasoning. Abstract science is a knowledge of the relations of quantity; physical science, that of causes and effects.

MATHEMATICS is that science which treats primarily of the relations and measurement of quantities, and secondarily of the operations and processes, by means of which these relations are ascertained. Considered as the science of exact relation, it is divided into three branches: *Arithmetic*, *Geometry* and *Analysis*.

ARITHMETIC treats of the relations of numbers, expressed by the aid of figures.

RATIO is the measure of the relation which one quantity bears to another of the same kind; that is, it is the number of times one quantity contains another regarded as the standard.

AN AXIOM is a self-evident truth or theorem. The truth must not only be self-evident, but it must be a necessary truth, universally true at all times and at all places.

2. What is a multiple of a number?

ANS.—The multiple of a quantity is a quantity which it will divide without a remainder.

3. Multiply one millionth by one and six thousandths, and divide the product by two ten thousandths.

ANS.—We have $.000001 \times 1.006 \div .0002 = .00503$.

4. Find the value of $7+1+3 \times 4-8-6 \div 3+1-7$. Also, $21 \div 3 \times 7-1 \times 1 \div 1 \times 4 \div 2+18 \div 3+6 \div (2 \times 2) + (4-2+6-7) \times 4 \times 6 \div 8$.

ANS.—Knowing that the signs $\times$ and $\div$ are of equal rank and take the precedence, we have (1) $8+12-8-2+1-7=4$, and (2) $49-2+6+1\frac{1}{2}+3=59\frac{1}{2}$.

5. Ten per cent. of 20% of 30% of 500 is 7 less than what number?

ANS.—The required number is $(\frac{1}{10} \text{ of } \frac{1}{2} \text{ of } \frac{1}{10} \text{ of } 500) + 7 = 10$.

6. At what rate per cent. will \$100 amount to \$114.50 in 1 yr. 7 mo. and 10 mo.?

ANS.—The interest on \$100 for the given time at 1%, is \$1.61 $\frac{1}{2}$; hence the rate is $14.50 \div 1.61\frac{1}{2} = 9\%$.

7. St. Petersburg is in longitude 30° E. and Denver 105° W; when it is 4:20 A. M., Jan. 1, at St. Petersburg, what is the time at Denver?

ANS.—The time is easily found to be 7:20 P. M., Dec. 31.

8. A hollow metal ball 2 ft. in diameter just floats in water; how thick is the metal if its specific gravity is 10?

ANS.—Since the metal is 10 times as heavy as an equal bulk of water, and in order that the ball should just float, the bulk of water displaced must be ten times the bulk of the metal; hence the hollow part is $10 - 1 = 9$ times the bulk of metal. Representing the ball by 10 and the hollow part which is also spherical and therefore similar to the ball, by 9, we can solve it on the principle that similar solids are to each other as the cubes of their radii. Therefore

$$10 : 9 :: 1^3 : (.96548938)^3,$$

and $1 - .96548938 = .03451062$ ft., is the thickness of the metal.

9. The shortest distance on the surface between the opposite corners of a cube is 10 in.; find a side of the square.

ANS.—Imagine one side of the cube to be hinged at an edge, and opened until the two sides form one plane. This rectangle is twice as long as wide, and the diagonal is 10 in. Since $10^2 = 100$ is the sum of the *squares* of the length and width of the rectangle, it is evident that the square of the width, or the edge of the cube, must be $100 \div (1^2 + 2^2) = 20$ sq. in., which is a side of the cube, whose edge is $\sqrt{20} = 4.472136$ in.

10. A locomotive whistle sounds at a distance of 56 rods from a crossing; a man 3 mi., 8 rds., 5 yds. and 1 ft. away hears the whistle just as the locomotive reaches the crossing; find the speed of the train, if the velocity of sound is 1142 ft. per second.

ANS.—The distance to the man is 15988 ft., and the time is $15988 \div 1142 = 14$ sec.; hence the rate of the train is $56 \div 14 = 4$ rds. per second, or 45 mi. per hr.

HISTORY.

1. For what is each of the following dates memorable: 1607, 1620, 1776, 1812?

ANS.—Jamestown settled by the London Co., May 23, 1607. First permanent settlement in New England by the Puritans, Dec. 21, 1620. Declaration of Independence passed July 4, 1776. War with Great Britain declared June 18, 1812.

2. Which of the four intercolonial wars was the most important? What was the chief cause leading thereto, and what do you regard as the most significant result springing out of it?

ANS.—The French and Indian, caused by disputes in territorial claims. The success of the English, whereby English laws, language and customs henceforth controlled the magnificent area now occupied by the United States, was the most significant result.

3. Give dates of the following: Founding of St. Augustine and Santa Fe, adoption of the Constitution, admission of Kansas, battle of Gettysburg.

ANS.—St. Augustine is said to have been founded Sept. 8, 1565, when Menendez built his fort on the site of the present city. Santa Fe, when visited by the Spaniards in 1582 was already a populous Indian pueblo. Hence the date of its founding is indeterminate, and Santa Fe is decidedly the oldest town in the U. S. The occupation of the town by the Spaniards, is usually dated from 1582, when Antonio de Espejo's expedition in search of Ruyz and his companion invaded New Mexico. The Constitution was adopted by Congress Sept. 17, 1787, and ratified by the 9th state (N. H.) which made the proposed government a fact, June 21, 1788, (see pp. 60 and 106 for full particulars). Kansas was admitted Jan. 29, 1861. Battle of Gettysburg, July 1, 2 and 3, 1863.

4. For what are we indebted to Morse? To Fulton? To Arkwright? To Goodyear? To Howe?

ANS.—For the telegraph, for the application of steam to navigation, the

founder or pioneer of the factory system (hardly the inventor of a machine for spinning cotton used by him), for the process of vulcanizing India-rubber, and for the sewing machine, respectively.

5. State two of the leading events of the following administrations: Jefferson's, Tyler's, Johnson's.

ANS.—Jefferson's—Purchase of La. and war with Tripoli. Tyler's—Dorr's Rebellion and Webster-Ashburton Treaty. Johnson's—Laying successfully the Atlantic Cable and the Purchase of Alaska.

6. For what in connection with American history is each of the following noted: Franklin, Lafayette, Arnold, John Brown, Gen. Meade?

ANS.—Franklin for his philosophy and statesmanship; La Fayette for his friendly assistance in the Revolution; Arnold for his infamous attempt to betray his country; John Brown as a champion of liberty in trying to free the slaves (for full account see p. 84); Gen. Meade for his able services in the Civil War, especially at the battle of Gettysburg.

7. What is meant by the Monroe Doctrine, the Missouri Compromise, the Dred Scott Decision, the Emancipation Proclamation?

ANS.—Monroe Doctrine, (see p. 59); Emancipation (p. 134); the Missouri Compromise every one knows. (answered several times in *Visitor*); the Dred Scott decision by the U. S. Supreme Court affirmed that negroes were chattels and could be carried by the owner wherever he pleased. Roger B. Taney was Chief Justice and supported the decision.

8. What was the financial condition and the Policy of the Government during Jackson's administration?

ANS.—Out of debt, practically, and the policy embraced the theory that "to the victors belong the spoils," and was opposed to spending public revenues upon internal improvements, and favored the removal of the Seminoles to the Indian Territory.

9. What advantages did England obtain from our Civil War? How did she assist the rebels?

ANS.—She gained commercial control in the South, and assisted in the support of the Confederate navy.

10. Classify the following: Bancroft, Whittier, Jos. E. Johnston, Cyrus W. Field, Ericsson, Bayard Taylor, Hull, Whitney, Kilpatrick, Edward M. Stanton, Cotton Mather, Jos. Hooker, W. H. Vanderbilt, J. B. McPherson.

ANS.—Bancroft, our greatest historian; Whittier, our oldest living poet; Johnston, an able Confederate general; Field, an American merchant and the successful Atlantic-Cable man; Ericsson, a Swedish engineer and inventor, the builder of the *Monitor*; Taylor, a noted American traveller, writer and poet; Hull, an able officer in the Revolution, and a general in the Mexican War, sentenced to be shot for surrendering with 2000 troops to the British at Detroit. Pres. Madison approved the sentence but remitted its execution in consideration of Gen. Hull's age and services in the Revolution; Whitney, the inventor of the cotton-gin; Kilpatrick, a gallant Union General in the Civil War; Stanton, statesman and lawyer, was Lincoln's Secretary of War; Mather, a celebrated theologian and writer of New England; Hooker, a captain in the Mexican War, and a Brigadier General in the Civil War; Vanderbilt, the money and railroad king; James Birdseye MacPherson, a brave, accomplished noble-hearted and fine-looking general in the Civil War.

NOTE.—The Bee-Line R. R. Co. will give a cheap excursion from this section to Niagara Falls and Toronto, early in August.

GEOGRAPHY.

1. Define orbit, ecliptic, horizon, zenith, nadir.

Ans.—*Orbit* is the path of a planet; *ecliptic* is the plane bounded by the earth's orbit; *horizon* is the plane passed tangent to the surface of the earth at any point, whose poles are at the *zenith* and *nadir*, points directly above and below the place.

2. State the different ways by which the atmosphere receives its heat.

Ans.—Primarily, by the earth from solar radiation; secondarily, by oceanic currents and by winds.

3. Why are the principal rainless districts of South America west of the Andes?

Ans.—Because the trade winds bring the moisture from the Atlantic, which is absorbed partly by the towering heights of the Andes.

4. Why are the tropics so placed on the maps?

Ans.—Because they limit the obliquity of the ecliptic.

5. What is the difference between a monarchy and a republic, with reference to government?

Ans.—In the one the government is in the hands of one person and in the other the people rule.

6. Give a topical outline for a recitation on Europe.

Ans.—For one recitation on Europe, the general outline may be used: Position; Boundaries; Surface; Drainage; Soil; Climate; Productions; Inhabitants; Occupation; Cities and Towns; Miscellaneous. But for a careful study of Europe, fifty topics may be given and twice as many sub-divisions.

7. Compare Florida and Michigan as to climate, soil, products, character and occupation of the people.

Ans.—Florida has the healthiest and most agreeable climate of the continent; yet that of Michigan is highly favorable to health and the production of fruit. Both have sandy soil, mixed with clay. Products of Fla. are cotton, rice, sugar, tobacco, lumber, fish, tropical fruits and sponges; of Mich., cereals, fruits, lumber, iron, copper, salt and fish. The people of Mich. excel in the promotion of education and in the arts and sciences. Fla. has no college and her school system is weak. Occupation in Fla. is confined mostly to agriculture and commerce; in Mich., to agriculture, lumbering, fishing, mining, commerce.

8. What are the characteristics of the surface of Holland? Mention its peculiarities.

Ans.—That the low grounds in the western part are from 16 to 20 feet below the level of the sea; protected by sea-dykes.

9. In what countries are the following cities located: Canton, Vera Cruz, Moscow, Dresden, Limerick, Manchester.

Ans.—China, Mexico, Russia, Germany, Ireland, England.

10. Where are the following articles produced: (a) Coffee? (b) Tea? (c) Sugar? (d) Cinnamon? (e) Cloves?

Ans.—(a) Coffee is produced in all civilized regions of the tropical world—Brazil, Costa Rica, Guatemala, Venezuela, Guiana, Peru, Bolivia, West Indies, Arabia, Java, Ceylon, East Indies, Abyssinia, Western Africa, and elsewhere. (b) Tea in China, Japan, Java, Farther India, etc. (c) Sugar in nearly all the tropical countries, notably in La., West Indies and northern part of S. America. (d) and (e) Cinnamon and cloves in Borneo, Celebes and adjacent islands.

NOTE.—A number of good friends have volunteered to raise clubs at the institutes. Please order sample copies and push the claims of our magazine.

SPELLING.

Pewter, precious, fellow, expel, transient, repel, deign, serge, shillalah, gauge, initiate, obscene, secede, strychnine, bilious, emissary, auxiliary, hibernal, noxious, diurnal.

GRAMMAR.

1. Give a complete classification of the noun.

ANS.—See text-book for classes, sub-classes, properties and declension.

2. What are auxiliary verbs? Name the auxiliaries that are sometimes used as principal verbs.

ANS.—See *Visitor* of Feb. p. 42, and of July p. 151.

3. Is it customary to apply gender to all the personal pronouns? Give reasons for your answer.

ANS.—Variety of form to distinguish the gender is confined to third person. Pronouns of the first and second person are either masculine or feminine; and when the sex of the speaker or person addressed is not known, we do not apply gender.

4. Explain the use of pronouns.

ANS.—The term is from the Latin *pronomem*, which signifies *for a noun*. Pronouns have been called *substitutes*, as they stand not only for nouns, but also for adjectives, for a sentence or part thereof, or a series of propositions. They have also been called *form-words*, because they do not express the idea of an object like nouns, but the *relation of an object to the speaker*.

5. Classify verbs and sentences with respect to form and to use.

ANS.—Verbs see p. 42. Sentences as to use are declarative, interrogative, exclamatory and imperative; as to form, simple, complex and compound.

6. State the difference between a finite and an infinite verb. Between a personal and relative pronoun.

ANS.—A finite verb is limited in person and number by a subject, and an infinitive is not. Personal pronouns show by their form of what person they are, and relative pronouns stand for antecedents to which they join limiting clauses.

7. Define the following terms: Modifier, Parsing, Analysis, Ellipsis, Synthesis.

ANS.—See pp. 43, 62, and 88.

8. What is it to decline a noun or pronoun. To compare an adjective. To conjugate a verb.

ANS.—To give its case forms. To give the variable forms that express different degrees of quality. To distribute properly the variations of the verb in its different voices, modes, tenses, numbers and persons.

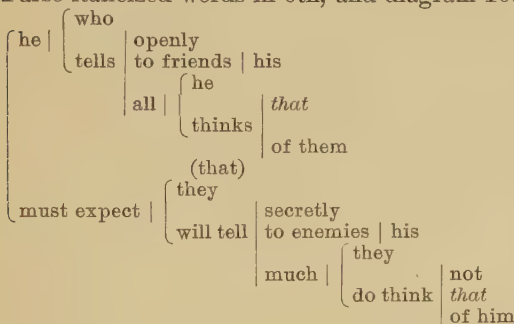
9. He supposed *it eight o'clock when* the train arrived. The traveler stopped *to ask what* was the matter.

ANS.—*It* is a pronoun, object of *supposed*. *Eight* is a noun, attributive object of *supposed*. *Of* is a preposition, showing the relation of *clock* to *eight*, and *clock* is its object. *When* is a conjunctive adverb, joining the adjective clause to *eight* and modifying *arrived*.

To ask is an infinitive with the construction of an adverb; it limits *stopped*, and governs the substantive clause, *what was the matter*, in the objective case. *What* does not admit an antecedent in this construction, and it may be parsed as an adjective or as an indefinite interrogative pronoun, constructed in its own clause.

10. He who openly tells his friends all he thinks of them, must expect that they will secretly tell his enemies much that they do not think of him.

Parse italicized words in 9th, and diagram 10th.



Editorial Notes.

This number is mailed at 8:30, A. M., July 31. Report tardiness in delivery.

Part of this edition has two pages numbered incorrectly; please change, if necessary. We do careful proof-reading, yet errors escape notice sometimes.

To the end of this year the *Visitor* shall be mailed about the first of each month. Persons failing to get each issue promptly, should notify publisher.

Prof. William Hoover, of Athens, Ohio, having pursued a thorough course of Post-Graduate study, received the degree of *Doctor of Philosophy* at the last Commencement of Wooster University. He read a "thesis" on *Cometary Perturbations*. The honor was certainly well merited, and we congratulate friend Hoover on this recognition of his fine scholarship.

The able address, entitled "American Citizenship," which was delivered by Dr. Herrick Johnson, of Chicago, at the dedication of Albert Lea College, has been handsomely printed in pamphlet form, and is sold at the low price of ten cents to aid in furnishing the College. Address orders to MRS. LAURA G. FIXEN, Albert Lea, Minn.

The August number of DEMOREST'S MAGAZINE comes to us freighted with good reading. Mrs. Croly contributes an interesting article on one of the typical dramatic stars, Genevieve Ward; Emma M. Tyng furnishes a good paper on *South Kensington and its Neighborhood*; and W. Jennings Demorest has two Prohibition articles, *What is Prohibition?* and *Liberty and Prohibition*. Mrs. Hart's serial is continued; there are several good stories and poems, one of the valuable series, *From Pencil to Brush*, and *The World's Progress*. The frontispiece is a fine steel engraving called *Harmony*.

Send 30 cents to agent, Ed. Ryneerson, Gettysburg, Ohio, for *An Alphabetical List of the Battles of the War of the Rebellion*, a pamphlet of 96 pages, size of *Visitor*. It is compiled from the Official Record, giving dates of all battles from Ft. Sumpter, April 12 and 13, 1861, to Kirby Smith's Surrender, May 26, 1865. It further gives the number killed, wounded and missing in both armies of important battles, and other useful information. Also, battles of the Revolution, Black Hawk's and Florida wars, of the wars with the Creeks, with the Northwest Indians, and with Mexico, and of the war between Mexico and Texas. It is valuable reference book of battles, and Mr. Ryneerson having a desire to benefit those, who, like him, are close students of history, offers to send it postpaid on receipt of price.

ENGLISH GRAMMAR.

Answers to Queries.

1. Diagram—The Germans in Greek

Are sadly to seek;
Not five in five score,
But in ninety-five more;
All save only Harmann,
And Harmann's a German.

—From *Preble Co. List* by CURIOUS.

		the
(Germans		in Greek
are sadly		to seek
		five not
(Germans,		in score
		but of Greeks
		in Greeks ninety-five
can be found		more
(all save Harmann		only
are-Greeks		
and		
(Harmann		
is-German		a

It seems somewhat difficult to get at the meaning of this quaint poetry, in which the rhyme possesses the chief merit. We like *jarman*.

2. Parse—Cease to do *evil* and learn to do *well*.

Ans.—*Evil* is a common noun, of the neuter gender, third person, singular number, objective case; it is the objective of *to do*. *Well* is an adverb of manner, and modifies the intransitive verb *to do*.

3. Diagram—Every age

Bequeaths the next for heritage,
No lazy luxury or delight.

S. F. B.

(age every		the
		to age next
		for heritage
(bequeaths		luxury no
		or
		delight lazy

4. Diagram—One day with life and heart,

Is more than time enough to find a world.

(day		one
		with life
		and
		with heart
		than
(is-time more		(time enough to find world a
		is

 We send Eubank's Key to Harvey's Analysis for two dimes only.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

397. What was the League of The Hague?

Ans.—It was the triple league against the aggressions of Louis XIV., of France, negotiated in 1668 by Sir William Temple with the Dutch and Swedes, while he was at The Hague as England's ambassador. This memorable negotiation occupied only five days.

EDITOR.

450. What constitutes a navy-yard? Locate the nine in the U. S.

Ans.—It is a ship-yard for the construction, repair and care of the vessels of war belonging to a national navy. There are now but three well-appointed and operative navy-yards in the United States; viz., at New York, Norfolk and San Francisco, with a repair arsenal at Washington. There have been seven only for some years. Our navy is in a deplorable condition, but we hope that this nation will never have occasion to use vessels of war in its defense against foreign aggression.

EDITOR.

966. How is glucose made?

PREBLE.

Ans.—Glucose is a constituent of the juice of grapes, plums, cherries, figs and many other sweet fruits. It likewise occurs in honey. In the animal kingdom, it is found sometimes as a normal and sometimes as a pathological constituent of various fluids and tissues. It can be obtained chemically from starch and from dextrine by boiling them with dilute sulphuric acid, or by the action of Diastase, and from cellulose and gum, and from most of the varieties of sugar, by treatment with dilute acids. In the liver, it is formed from the Glycogen which occurs in that organ, while in the rest of the organism it is formed from the starch which is taken with the food. J. H. W. SCHMIDT.

The production of glucose has become an important American industry. Over 10,000,000 bushels of corn are annually used in its manufacture. The corn is first soaked several days, then ground on stones over which a stream of water flows. The material is next washed through a bolting cloth, and the starch separated. This is then treated with dilute sulphuric acid. During the process of conversion, which takes about two hours, steam is allowed to bubble into the mixture. The acid is afterwards neutralized by marble dust and animal charcoal. Glucose thus produced is a thick syrup, used chiefly in making table syrups and confectionery, in brewing ale and beer, and as food for bees. It is wholesome and unobjectionable in its nature, and has greatly reduced the price of cane sugar. It is about $\frac{2}{3}$ as sweet as cane sugar. Dr. Fahlberg has lately discovered a sweetening agent made from coal tar, to be known as saccharine, that is 230 times sweeter than the best sugar. It is antiseptic, wholesome, and will be used likely to sweeten glucose sugars.

EDITOR.

967. What was the "Lasker Incident," 1884?

Id.

Ans.—Prof. Edward Lasker, a well-known politician of Germany, died suddenly in January, 1884, at New York, while traveling for his health. As a tribute of respect to his memory, the House of Representatives passed resolutions of regret and forwarded the same to the German reichstag. Sargent, our minister to Berlin, delivered the resolutions to Prince Bismarck, as chancellor of the empire, and the prince, taking exception to the commendation of the political principles of Lasker, refused to present the resolutions and returned them to the body whence they came. This agitated political circles in both countries and elicited a lively discussion in both legislative bodies. Ochiltree, of Texas, having a brother of the deceased among his constituents, was the mover of the resolutions.—*School Herald*.

PROPOSER.

968. What was the "Doctors Mob" of revolutionary times? Id.

Ans.—In 1788 a serious riot occurred at the New York hospital occasioned by violations of the grave for the purpose of procuring subjects for dissection,

and the careless exposure of the dissected bodies. The doctors were mobbed and their houses invaded. Some of them fled from the city and others took refuge in the jail. The mob attempted to force the prison and were resisted by Hamilton, Jay, and a body of citizens. In the conflict Jay received a wound in the temple which confined him to his bed for some time and interrupted his contributions to the *Federalist*. W. C. BINKLEY.

969. Where and what is *Krakatau*?

Id.

Ans.—It is an island in the straits of Sunda, between Java and Sumatra, upon which a volcano of the same name was the scene of one of the most terrific outbursts on record, Aug. 27, 1883. Lockyer affirmed that the tidal waves produced by that eruption traveled no less than four times around the earth before their effect ceased to be recorded by the tide gauges. EDITOR.

970. What is the 5th essence—*quintessence*?

Id.

Ans.—The word *quintessence* is of ancient origin, and dates from the time when it was generally believed that the simple elements or constituents of bodies were four in number; viz., fire, air, earth and water; and that earth was the lowest element, being grosser than water, and water than air, and air than fire. Some Pythagorean philosopher, not satisfied that these four elements or essences sufficed for the composition of all things, added to them a *fifth* and higher element or *essence* named *ether* and located in the uppermost regions of the sky. J. H. W. SCHMIDT.

971. What is the sacred "Stone of Scone" in English history? *Id.*

Ans.—Scone is a parish in Perthshire, Scotland, lying on the left bank of the Tay. It is famous as the seat of the most ancient of Scottish abbeys, and is first mentioned in the beginning of the 10th century, when a council was held there in the 6th year of the reign of King Constantine, at which time it is styled, by the chronicler of the fact, *regalis civitas*, the royal city. A monastery was built there about the same period, and there was located the famous "stone" on which the Kings of the Scots were inaugurated, and which was carried by Edward I., of England, to Westminster Abbey. S. B. KECKLER.

This stone was reputed to have been the pillow on which Abraham rested his head in the vision of heaven, and to have been brought to Scotland by the first Christian missionaries from Ireland. Since Edward's time, as stated above, it has remained in Westminster Abbey, and all his successors have been crowned sitting in the chair of which it forms a part. EDITOR.

972. Was any President of U. S. ever married while in office? *Id.*

Ans.—The nine weddings that occurred in the White House are as follows: John J. Jackson to Miss Todd in 1811; Mr. Gouverneur to Martha Monroe in 1820; J. Q. Adams, jr., to his cousin, Miss Johnson, in 1826; Mr. Paquet to Miss Lewis during Andrew Jackson's term of office; Mr. Polk, of Tenn., to a niece of Pres. Jackson during this administration; Mr. Waller, of Va., to Miss Tyler during her father's administration; Mr. Sartoris, of England, to Nellie Grant; another marriage during Grant's administration was Gen. Hastings to Miss Emily Platt; Grover Cleveland to Miss Frances Folsom; John Tyler had the wedding reception of his second marriage in the White House, and Pres. Hayes and wife celebrated their silver wedding there. ED. RYNEARSON.

From the *Weekly Astorian*, published at Astoria, Oregon, June 18, we get the following: The first wedding at the White House was Miss Todd, a relative of Mrs. Madison, to John G. Jackson, of Virginia; John Quincy Adams, jr., to Miss Johnson, his cousin; Mr. Paquet and Miss Lewis; Mr. Polk and Miss Easton; Wm. Waller and Elizabeth Tyler in 1842; Pres. Tyler and Miss Gardiner; Mr. Sartoris and Nellie Grant, 1874; Gen. R. Hastings and Miss Emily Platt; Grover Cleveland and Miss Folsom, June 12, 1886.

H. G. THOMAS, *German, Ohio.*

973. Locate the mints of the U. S.

S. A. S.

ANS.—There are now five mints, located at Philadelphia, established by act of Congress April 2, 1792, at New Orleans, (1835), at San Francisco, (1854), at Carson City, (1870), and at Denver, (1864). The first three are in active operation. The mint at Carson City is equipped for coinage, but its business is now that of an assay office only. The one at Denver has never been used except as an assay office. There are assay offices also at New York, St. Louis, Boise City, Helena, and at Charlotte, N. C. At present the following coins are struck: *Gold*, double-eagle, eagle, half-eagle, three-dollar, quarter-eagle, dollar; *Silver*, dollar, half-dollar, quarter-dollar, dime; *Minor Coins*, of nickel and bronze, 5-cent, 3-cent, cent. The total amount of coinage in the United States from the organization of the mints in 1793 to the close of the fiscal year ending June 30, 1885, is as follows: *Gold*, \$1,389,981,595.50; *Silver*, including trade-dollars, \$434,224,610.00; *Minor Coin*, \$17,463,608.44. EDITOR.

974. In how many languages is the name of God known? *Id.*

ANS.—The name of God, which is of Anglo-Saxon origin, has been translated into nearly every known language. Myrtle George says 242 languages. It may be interesting to our readers to have the name in the following 100 languages, as given by the French philologist, Louis Berger, and others.

Abyssinian, *Agzi*; Æolian and Doric, *Ilos*; Albanian, *Bogo*; Angolese, *Anub*; Arabic, *Allah*; Armenian, *Alek*; Armorican, *Teuti*; Assyrian, *Ellah*; Bactrian, *Sila*; Beotian, *Ario*; Bohemian, *Bueg*; Brahman and Zetlandic, *Bora*; Briton, low, *Doue*; Cabbalist, *Alga*; Californian, *Solu*; Cambodian, *Miri*; Canadian, *Bib*; Carmanian, *Suna*; Celtic and old Gallic, *Diu*; Chaldaic, *Elah*; Chilian, *Hana*; Chinese, *Pussa*; Congo, *Aneb*; Copt, *Theos*; Coromandel, *Brama*; Cretan, *Thios*; Croatian, *Doga*; Cyrenian, *Popa*; Dalmatian, *Rogt*; Danish and Swedish, *Gut*; Dutch, *Godt*; East Indian, *Zeul*; Egyptian, *Tenu*; Elamite, *Para*; English, *God*; Etrurian, *Chur*; Finnish, *Jumala*; Flemish, *Goed*; French, *Dieu*; Georgian, *Moti*; German and Swiss, *Gott*; Greek, *Theos*; Hebrew, *Elohim*; Hetrurian, *Esar*; Hindostanee, *Rain*; Hungarian, *Bogi*; Icelandic, *Gudi*; Illyrian, *Boog*; Indian, *Tura*; Irish, *Dia*; Italian, *Dio*; Japanese, *Gœzur*; Lapp, *Jubinal*; Latin, *Deus*; Madagascar, *Zannar*; Magi, language of, *Orsi*; Malay, *Alla*; Maldivian, *Orba*; Margarian, *Oese*; Melindian, *Abag*; Mesopotamian, *Ella*; Mexican, *Bosa*; Mogor, *Alli*; Muscovitic, *Tios*; Narsingian, *Bila*; Negro, *Abgd*; Norwegian, *Gud*; Ormusian, *Alai*; Olala Tongue, *Dev*; Pannonian, *Istu*; Paraguayan, *Puir*; Persian, *Sire*; Peruvian, *Puchecammae*; Philipian, *Mora*; Pollacca, *Bung*; Polish, *Boq*; Portuguese, *Deos*; Provencal, *Dion*; Prygian, *Zeut*; Quintensian, *Hoba*; Runic, *As*; Saracen, *Agdi*; Scotch, *Goot*; Spanish, *Dios*; Slave, *Buch*; Syriac and Turkish, *Alah*; Tartar, *Magatal*; Thracian, *Kalo*; Teutonic, *Goth*; Thibetan, *Gena*; Tyrrhenian, *Eher*; Wallachian, *Zeuc*; Zembian, *Fetizo*.

EDITOR.

975. What does the suffix *ana* signify? *Id.*

ANS.—It is a Latin plural termination, of comparatively modern origin, relating to a distinct species of composition, comprising the literary anecdotes, critical reflections, and historical incidents, mingled with the details of *bon mots* and ludicrous tales, of eminent men, delivered in conversation and recorded by their friends or discovered among their papers after their decease. Vestiges of *Ana* may be traced in the classical ages, but the term was first applied to such collections as above stated about the beginning of the 15th century. Poggio was the first person whose remarks and *bon mots* were collected under the name of *Ana* (*Poggiana*), and *Scaligerana*, which contains the opinions of Joseph Scaliger, was the first work published under that appellation, and accordingly led the way to that class of publications. The French excel in this class of literature, but the most remarkable *Ana* in the English language—and indeed, in any language—is to be found in a work which does not correspond to the normal type either in name or in form. It is Boswell's *Life of Samuel Johnson*, LL. D. Next in rank of the same kind is Selden's *Table Talk*. See *Encyclopedia Britannica*.

EDITOR.

976. What were Pestalozzi's nine laws of education? *Id.*

Ans.—1. Activity is the law of childhood. Accustom the child to do—educate the hand.

2. Cultivate the faculties in their natural order. First form the mind and then furnish it.

3. Begin with the senses, and never tell a child what he can discover for himself.

4. Reduce the subject to its elements. One difficulty at a time is enough for the child.

5. Proceed step by step; be thorough.

6. Let every lesson have a point.

7. Develop the idea, then give the term.

8. Proceed from the known to the unknown.

9. Synthesis, then analysis; not the order of the subject but the order of nature. *R. A. LEISY.*

The nature of man, and what each child is to know, must determine what and how he shall be taught. This nature is organic; a unity, consisting of faculties developing in regular order. All true education consists in developing this nature, slowly, harmoniously, beginning in the home and from the cradle. This development must precede all special training. The object is not knowledge, chiefly, but power and skill. The faculties develop through self-activity. The duty of the teacher is to remove obstacles to their spontaneous development, and to stimulate. This activity begins with perception, with the simple, the near at hand, that is, with object lessons, leading thence to the synthetic, to generalizations. The means of development are form, number and language.

On this fundamental doctrine, Pestalozzi seems not to have been clear, at least in his exposition, but in his discussions of form he brought out drawing and inventive Geometry, and reduced writing to a system. He recognized a moral element in man's nature, which he would develop in the same way, from within. In discipline he would win the love of the child for the teacher, his friend; which leads to patience, obedience, justice, liberty, and an ideal school. *ED. RYNEARSON.*

977. If the earth should stop revolving on its axis what would be the result? *L. H. EVERETT, New Lisbon, Ohio.*

Ans.—The succession of day and night would cease and the waters of the equatorial regions would flow towards the polar regions, leaving the surface about the equator dry land. *B. F. FINKEL.*

978. Give etymology of *frustum*. Why *frustum* formerly? *S.*

Ans.—*Frustum* is from the Latin *frusto*, to break, and signifies a piece or part of a solid separated from the rest. A number of old works on mathematics have *frustum*, but we can not account for that form of the word. *ED.*

979. What became of the seal of Southern Confederacy? *Ep.*

Ans.—Some authorities state that the seal was thrown in a well near Charleston, S. C. Others say that a man in New York has possession of it. *ED. RYNEARSON.*

980. Who said "I will find a way or make one"? *Id.*

Ans.—It was said by the famous Hannibal, a great Carthaginian general and the hero of the second Punic War. In the spring of 218 B. C. he began his memorable march from New Carthage (Cartagena) with an army of 90,000 foot, 12,000 horse, and 37 elephants, to cross the Alps and invade northern Italy. The Ebro was easily crossed; then came trouble with the native tribes, but leaving Hanno with a force of 10,000 foot and 1000 horse, he crossed the Pyrenees. Thence to the Rhone under discouragements, but he crossed and commenced the passage of the Alps. By this time his army had been reduced to about 20,000 infantry and 6000 cavalry, but the elephants were all there. When

he reached *White Rock*, at the top of the pass, it being the 9th day, he halted his infantry while the cavalry and beasts of burden made their way during the night to the summit and spoke cheering words to his half-frozen Africans and Spaniards. The descent of the Italian slope of the Alps covered with recent snows, was considered trying and dangerous, and a passage had to be constructed, and in view of this his despondent subjects were ready to retrace their steps. It was then that he uttered the inspiring words of the query, and after working three days to cut a passage leading into the valley of Aosta, they descended, and by October, 218 B. C., the great general saw the passage of the Alps accomplished, and his army comfortably encamped in northern Italy.

EDITOR.

981. Whence came the Piqua tribe of Indians?

DARKE.

Ans.—They were inhabitants of old Chillicothe, a Shawanoese village on Massie's Creek, 3 miles north of where Xenia now stands. This village was the ancient Piqua of the Shawanoese, and occupied the site of the present village of West Boston. It was sacked and burned Aug. 8, 1780, by an army of 1000 men from Kentucky. The Shawanoese never rebuilt it. They removed to the Great Miami and erected another town which they called Piqua, after the one just destroyed and in defence of which they had fought with the skill and valor characteristic of their nation.

CHAS. H. BIGLER.

Col. John Johnston, a celebrated agent of the U. S. Government over the Indians, and whose place furnished the site of the now flourishing town of Piqua, says: "The word *Piqua* is the name of one of the Shawanoese tribes, and signifies 'a man formed out of the ashes.' The tradition is, that the whole Shawanoese tribe, a long time ago, were assembled at their annual feast and thanksgiving. They were all seated around a large fire, which having burnt down, a great puffing was observed in the ashes, when behold! a full-formed man came up out of the coals and ashes; and this was the first man of the Piqua tribe." He further says that the Shawanoese (*the south*) came from Florida, and that there were at one time 4000 of them at Upper Piqua. In the French war, which ended with the peace of 1763, a bloody battle was fought on Col. Johnston's farm, in which the Shawanoese were allies of the English, and who aided in the siege against the French and Indians, which lasted over a week. Soon after the Miamis and their allies left and the Shawanoese took their places. The present Piqua was laid out in 1809 by Brandon and Manning, under the name of Washington, which it bore for many years.

EDITOR.

982. Describe the *third* motion of the earth.

W. S. D.

Ans.—We presume Mr. Davidson alludes to the motion produced by the variation in the position of the earth's axis with reference to the ecliptic, which may be compared to the motion of a spinning-top. The period of revolution as given by Delambre in his astronomical tables is about 25,868 years. The explanation, we think, must be derived from the study of the *Precession of the Equinoxes*, which every good Astronomy gives. See Prof. Hoover's answer to query 570, p. 70, Vol. 6, *School Visitor*.

EDITOR.

983. Who invented the sword? Spinning Jenny?

NOAH COOL, *Laura, Ohio.*

Ans.—(a) The invention of the sword dates beyond the ken of history; but it is probable that the Tubal-cain, spoken of in Gen. 4-22, invented it.

J. H. W. SCHMIDT.

(b) In 1764 Jas. Hargreaves invented the Spinning-Jenny, by means of which eight threads instead of two, were drawn out. This number afterwards reached eighty, and ultimately the number was greatly increased. The invention of the Spinning-Mule by Crompton in 1779, has enabled modern manufacturers to carry the process of spinning to such a degree of perfection that a pound of cotton has been spun into a thread 4770 miles in length.—*People's Cyclopaedia.*

S. B. KECKLER.

984. Give incidents with which the names of Betty Zane, Mrs. Bratton, Mrs. Motte, Mollie Pitcher, Jane McCrea, Emily Geiger, Lydia Darrah and Molly Stark are connected in U. S. History.

EDITOR.

ANS.—Betty Zane is called by Triplett, the heroine of Ft. Henry, now Wheeling, W. Va. On Sept. 11, 1782, the "Queen's Rangers" under Captain Pratt, and 300 Indians laid siege to this fort. The whole body of British and Indians was under the command of the infamous Simon Girty. Within the fort were 40 women and children with 18 men. Capt. Boggs had command of this fort. About 60 yards from the fort stood the residence of Col. Zane, temporarily abandoned for the better protection of the fort. When the powder in the fort was about all, it was announced that a keg was in the house just mentioned, and volunteers were called for to bring it. Miss Zane, sister of Col. Ebenezer Zane, who had just completed her education at Philadelphia, came forward, and swift as an Atalanta, she sped to the house. The besiegers were astounded, but on her return from the house with the powder, they tried to intercept her and volleys of bullets were fired at her, but she entered the gate unharmed. With the ammunition thus secured, the garrison held out for several days, when the enemy raised the siege and fled.

In June, 1780, a party of cavalry sent by Cornwallis, stopped at the house of Mrs. Bratton, and asked where her husband was. "In Sumpter's army," she promptly replied. Incensed at this avowal, the commander was prevented from killing her only by the solicitation of a brother officer. During the night the patriots learned of the invasion and captured the enemy. Among the prisoners was an officer, on whom, for previous offences, the death sentence was pronounced. As a last favor, he begged to be led into the presence of Mrs. Bratton. She recognized him as her preserver and saved his life by her intercession.

The British were occupying the house of Mrs. Motte and she carried Lee a bow and quiver of Indian arrows, with which he threw fire upon the roof of the house thus compelling the occupants to surrender.

Mollie Pitcher was noted for her bravery at the battle of Monmouth. When her husband, for whom she had carried water, was shot she grasped the rammer, and fired the cannon upon the enemy with deadly effect.

Jane McCrea was the betrothed of Capt. Jones of the British army. She lived with her brother at Ft. Edward and upon Burgoyne's approach he, being a whig, started for Albany. But hoping to meet her lover, she lingered at the house of Mrs. McNeil, a staunch royalist. One morning the house was surprised by Indians, who dragged forth the inmates and hurried them toward Burgoyne's camp. Mrs. McNeil arrived safe. But among the trophies brought in by a second party was the long, glossy hair of the fair damsel, Jane McCrea.

Gen. Greene had a message to be delivered to Gen. Sumpter, but as the country was abounding in Tories all shuddered at the task except a young heroine, Emily Geiger by name. Greene gave her the letter and also told her the contents. She mounted a swift horse and near the close of the second day's journey she was hailed by two Tories who arrested her on suspicion. While confined in a room awaiting the arrival of the woman who was to search her, she tore up the letter and swallowed it. Nothing being discovered by the matron's careful investigation, she received many apologies for her detention and was allowed to proceed. She was able to give Sumpter the desired information and Rawdon was soon flying before the Americans.

Lydia Darrah, at whose house the British Adjutant-General was staying, heard their plans to attack Washington, and on the next morning Dec. 4, 1777, she pretended to be going to mill, received a pass from Howe, and delivered the news to Lieutenant-Colonel Craig, whom Washington had sent out as a scout. At night Howe moved out of Philadelphia and attacked Washington's army but did nothing. The Adjutant-General said, "It is certain we were betrayed, yet how I can not imagine unless the walls of the house tell tales."

Mollie Stark was the wife of the brave, heroic, and patriotic Gen. Stark. At Bennington Gen. Stark said to his men, "There are the Red-coats; we beat them to-day, or Mollie Stark is a widow."

ED. RYNEABSON.

985. Name the three greatest clergymen, statesmen, senators, and women, now living in the U. S. P. J. SHAFER, *Red Wing, Minn.*

Ans.—Among the *many* great people living in this country at present, it is a hard matter to make a selection to suit everybody. Mine would be the following: *Clergymen*—T. DeWitt Talmage, Henry Ward Beecher and Timothy Dwight; *Statesmen*—Allen G. Thurman, Thos. F. Bayard and James G. Blaine; *Senators*—Wm. G. West, Daniel W. Voorhees and Geo. F. Hoar; *Women*—Belva Lockwood, Louisa M. Alcott and Rose Cleveland.

J. H. W. SCHMIDT.

986. Soon after the war a Northern writer, who gave his initials "S. M. S." wrote a *History of the Civil War in the U. S.* Who was (or is) S. M. S.? JULIUS A. SHEETS, *Calvary, Va.*

987. How many satellites has Mars? By whom and when were they discovered? What is their time of revolution? R.

Ans.—Mars has two satellites discovered by Prof. Asaph Hall, of the U. S. Naval Observatory, in August, 1877. The distance of the inner, which he called Phobos, is about 3,600 miles from the surface of Mars, and that of the outer, which he called Deimos, 12,300 miles. Phobos makes one revolution in 7 hr. 39 min. and Deimos in 30 hr. 17 min. The inclination of their orbits to the plane of the ecliptic is about 25°. The diameter of Phobos is estimated at 7 miles and of Deimos 6 miles.

W. C. BINKLEY.

When nearest the earth these little companions of Mars shine as stars of the 12th or 13th magnitude. The rapid revolution of the inner moon produces a unique spectacle. The Martian day being only $37\frac{1}{2}$ min. longer than ours, it follows that Phobos will make over three entire circuits daily. To a spectator on Mars, it will rise in the west and set in the east, going through all the phases of our moon in rapid succession, making it possible for two full moons to occur in a single night.

EDITOR.

988. Does the sun always shine on some portion of the U. S. *Id.*

Ans.—The summer sun never sets upon its whole extent, for a new day dawns upon the forests of Maine before its predecessor has quitted the westernmost islands of Alaska.

WARREN LOY.

Mr. Loy is correct, for the western extremity of Alaska embraces Attou, the westernmost island of the Aleutian chain (lat. 53° , long. 173° E.), where the sun does not set at the summer solstice till about $8\frac{1}{2}$ o'clock, and the sun rises in the eastern part of Maine at about $4\frac{1}{2}$ o'clock on the longest day. Knowing that the difference of time between the points just named is eight hours, and that the difference between sunset in Alaska and sunrise in Maine is only $(12-8\frac{1}{2})+4\frac{1}{2}=7\frac{1}{2}$ hours, the reader can readily see that for two months at least the sun's rays may not be hidden from some portion of the U. S. EDITOR.

Credits.

J. W. KECKLER, *Weaver's, Ohio*, 972, 973, 975, 977, 988.

WARREN LOY, *Pymont, Ohio*, 972, 977.

W. C. BINKLEY, *Cincinnati, Ohio*, 968.

J. H. SWARNER, *Painter Creek, Ohio*, 984.

ED. RYNEABSON, *Gettysburg, Ohio*, 966, 970, 971, 973, 975, 978, 980, 983.

J. H. W. SCHMIDT, *Ansonia, Ohio*, 966, 968, 974, 976, 983.

MYETLE GEORGE, *Gettysburg, Ohio*, 973, 974, 975.

S. B. KECKLER, *Weaver's*, 970, 973, 975.

MAMIE STOLTZ, *Gettysburg, Ohio*, 972, 874.

B. F. FINKEL, *Amanda, Ohio*, 972, 973.

NOAH A. WARE, *West Manchester, Ohio*, 968.

CHARLES BIGLER, *Gettysburg, Ohio*, 972, 982.

QUERIES.

1006. Give author of following. J. H. SPENCER, *Hollansburg, O.*
 1. To die is to land upon some silent shore.
 2. Count that day lost whose low descending sun
 Views from thy hands no noble action done.
1007. What is known as "The Maiden Town"? *Id.*
1008. Define industrial and manual schools. What distinction between them? Name the seven elementary tools.
 S. R. BAILEY, *Kansas City, Mo.*
1009. "Mark that man, for he is in himself a host. Let me see him no longer." In what battle and by whom was this command given? Who is meant?
 NOAH A. WARE, *W. Manchester, O.*
1010. Why is the Pacific calmer than the Atlantic? CHAS. BIGLER.
1011. Give an account of the Aroostook War. L. M. O.
1012. Explain the method of telegraphing from running R. R. trains. *Id.*
1013. How many telegraphic alphabets in use? Did Morse invent one?
 WARREN LOY.
1014. What is the best theory as to the origin of the glacial period?
 L. B.
1015. Who were the "six boy kings" of England? *Id.*
1016. Define *Americanist* and *Boodle*. Give origin of latter. *Id.*
1017. What is smoke, and what becomes of it? E. N. M.
1018. Describe Victoria Falls, Africa, and give their height. *Id.*
1019. By what common name are the big trees of California known?
Id.
1020. Who wrote the following and where found?
Id.
 Breathes there the man with soul so dead,
 Who never to himself hath said,
 "This is my own, my native land!"
1021. Give a brief sketch of Phillis Wheatley, Hannah Duston and Mercy Warren.
 LAURA.
1022. What is known of the elect lady to whom John addresses his Second Epistle?
Id.
1023. When and how did the political platforms as now in vogue originate?
 PREBLE.
1024. A letter was recently deposited in the Cin. P. O., addressed to Gate City, No Man's Land. Where should the "Nixie" clerk send it?
 W. C. BINKLEY.
1025. Mention some notable "Dark Days," and give the cause of these unusual obscurations of the sun?
Id.
1026. Who have been impeached by the House? Why? M. C.
1027. Explain the meaning of the phrase in italics—Let him remember that ambition, like the *Amrita cup of Indian fable*, gives to the virtuous an immortality of glory and happiness.—*Grimpeke*. *Id.*
1028. Who is known by the famous name, as "Herd Laddie"? Give a short sketch of his life.
 JOHN YOUNG, *Packerton, Pa.*
- Answers should be received on or before Sept. 4.



EDITED BY

JOHN S. ROYER.

VOL. VII.

SEPTEMBER, 1886.

No. 9.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

904. The frustum of a cone, bases r_1 and r_2 , length l , is twisted by a couple whose moment is M ; required the total angle of twist.

By PROF. DEVOLSON WOOD, *Hoboken, New Jersey.*

$$M = Pa = G_l^a I_\rho = G \frac{da}{dx} I_\rho \dots \dots (1),$$

In which a is the total angle of torsion, l , the length of the frustum, I_ρ , the polar moment of inertia of a transverse section, and G , the coefficient of elasticity for torsion. If the length be infinitesimal, then the angle of torsion will also be infinitesimal. Representing the variable length by x , we have the fourth member of the equation, from which we find

$$a = \frac{M}{G} \int_0^l \frac{dx}{I_\rho} \dots \dots (2).$$

For circular sections $I_\rho = \frac{1}{2} \pi \rho^2$, and in this example ρ is variable, to find which we have, at a distance x from the smaller end,

$$\rho = r_1 + \frac{r_2 - r_1}{l} x,$$

And equation (2) becomes

$$a = \frac{2M}{\pi G} \int_0^l \frac{dx}{\left(r_1 + \frac{r_2 - r_1}{l} x \right)^4} = \frac{2M}{3\pi G(r_2 - r_1)} \left(\frac{1}{r_1^3} - \frac{1}{r_2^3} \right).$$

NOTE.—Henry Gunder sent a solution, somewhat different, resulting in

$$a = \frac{2Ml}{3\pi G(r_2 - r_1)} \left(\frac{1}{r_1^3} - \frac{1}{r_2^3} \right).$$

His calculations are based on Thompson & Tait's formulæ, etc., quoting, "For a solid or hollow circular cylinder, each section is turned around the axis of the cylinder through an angle equal to the applied couple, divided by the product of the moment of inertia of the circular area into rigidity of the substance."

905. I have a uniformly tapering log, the sum of the diameters of whose ends is 4 feet; and if the difference of the diameters of the ends be subtracted from its length the remainder is 24 ft. Now, admitting the center of gravity of the log to be 17 feet from the small end, tell the diameters of the ends and length of the log.

A. L. FOOTE.

By WM. WILEY, 86 Jefferson Ave., Detroit, Mich.

Let $2x$ = smaller diameter. Then $4 - 2x$ = larger diameter, and $4 - 4x$ = their difference. Let y = length, and

$$y - 4 + 4x = 24; \text{ whence } y = 28 - 4x.$$

By the well-known formula, the distance from the top to the center of gravity is

$$\frac{1}{4}h \frac{(R+r)^2 + 2R^2}{(R+r)^2 - Rr}, \text{ where } h \text{ is the length, } R \text{ and } r, \text{ radii of bases.}$$

Substituting,
$$(7-x) \frac{4+8-8x+2x^2}{4-2x+x^2} = 17.$$

This reduces to $2x^3 - 5x^2 + 34x = 16$, whence $x = \frac{1}{2}$, and $2x = 1$, smaller diameter, $4 - 2x = 3$, the larger, and $28 - 4x = 26$, length.

906. Two men killed a deer. Wishing to divide it equally and having no convenient way of weighing it, they procured a pole, and placed it over a limb, and A who weighed 120 lb. balanced B who weighed 130. Then A taking the deer exchanged places with B, and B balanced A and the deer: what is the weight of the deer? Simple solution.

B. F. FINKEL.

By R. A. LEISY, Burton City, Ohio.

Evidently A at first has the long end of the pole, and the weight at B's end will always be $\frac{1}{2}$ of the weight at other; hence $\frac{1}{2}$ of $130 = 140\frac{1}{2}$ pounds, weight of A and the deer balanced by B, and the deer weighs $140\frac{1}{2} - 120 = 20\frac{1}{2}$ pounds.

By DR. S. P. BARTLETT, East Dixfield, Me.

Let x = weight of deer. Then $120 : 130 :: 130 : 120 + x$, or $14400 + 120x = 16900$, whence $x = 20\frac{1}{2}$.

907. Given $(x^6+1)y - (y^2+1)x^3 \dots (1)$ and $(y^6+1)x - 9(x^2+1)y^3 \dots (2)$, to find x and y .

G. A. STINE, Lindsey, Ohio.

By B. F. FINKEL, Amanda, Ohio.

Divide (1) by x^3y and (2) by $3xy^3$, add the results and extract the square root of the sum, and find

$$y + \frac{1}{x^3} = (x + \frac{1}{x})\sqrt[3]{3} \dots \dots \dots (3).$$

Substituting the value of the first member of (3) as found in the first operation $[(1) \div x^3y]$, we have

$$x^3 + \frac{1}{x} = (x + \frac{1}{x})\sqrt[3]{3} \dots \dots \dots (4).$$

Divide (4) by $x + (1 \div x)$, and by adding 3 to the result and extract the square root gives (5), and by subtracting 1 and extract the square root gives (6),

$$x + (1 \div x) = \sqrt{(\sqrt[3]{3} + 2) \dots (5)}. \quad x - (1 \div x) = \sqrt{(\sqrt[3]{3} - 1) \dots (6)}.$$

From (5) and (6), $x = \frac{1}{2}[\sqrt{(\sqrt[3]{3} + 3)} + \sqrt{(\sqrt[3]{3} - 1)}]$.

Substituting this value of x in (3), we easily find

$$y = \sqrt[3]{3} \sqrt{(\sqrt[3]{3} + 3)} \pm \sqrt{(3\sqrt[3]{9} - 1)}.$$

908. If 4 liters of water and 1 liter of sulphuric acid, specific gravity 1.842, when mixed shrink $\frac{1}{4}$ of 1%, what is the specific gravity of the mixture?

J. B. SANDERS, *Cambridge City, Ind.*

By J. C. GREGG, *Brazil, Ind.*

Let a = weight of one liter of water; then $1.842a$ = weight of a liter of the acid, and $5.842a$ = weight of mixture. The weight of an equal bulk of water after contraction is $5a \times .99\frac{3}{4} = 4.9875a$, but the weight of the mixture remains the same, and the specific gravity is easily found to be $5.842a \div 4.9875a = 1.1713+$.

909. A pays B \$230 as the present value of \$300 due in 5 years. Which gains by the payment, and how much, if interest is reckoned at 5%? *Id.*

By A. M. SCRIPTURE, *Clinton, N. Y.*

A gains \$10 and the interest thereon for 5 yr., or $10 \times 1.25 = \$12\frac{1}{2}$, because the present worth of \$300, for the given time and rate, is $\$300 \div 1.25 = \240 . But he paid only \$230.

By JOHN S. ROYER, *Gettysburgh, Ohio.*

Since gains on investments are usually determined when the income is realized, A's investment at interest, for 5 years at 5%, amounts to $\$230 \times 1.25 = \287.50 and the gain is \$12.50. But if we estimate the worth of A's money by *annual* interest, the amount of his investment would be $\$230 \times 1.25 + (\$11.50 \times .05 \times 10) = \293.25 , and his real gain only $\$300 - \$293.25 = \$6.75$.

910. At each angle of a triangle, being on a level plain and having sides respectively 40, 50 and 60 feet, stands a tower whose height equals the sum of the two sides including the angle. Required the length of a ladder to reach the top of each tower without moving its foot.

D. H. DAVISON.

By HENRY GUNDER, *North Manchester, Ind.*

Let ABC be the triangle, $AB = 40 = c$, $AC = 60 = b$, $BC = 50 = a$, and let l = length of ladder and P its foot. Drop PD perpendicular to CB and PE perpendicular to AB . Let $BD = z$ and $PE = t$. Then $PD \sqrt{[t^2 - (a+c)^2 - z^2]} = N^{\frac{1}{2}}$ say, and $PE = \sqrt{[t^2 - (a+c)^2 - t^2]} = M^{\frac{1}{2}}$

say; and since $l^2 - (a+c)^2 - z^2 = l^2 - (a+b)^2 - (a-z)^2$, we have

$$z = \frac{(a+b)^2 - (a+c)^2 + a^2}{2a}, \text{ and likewise } t = \frac{(b+c)^2 - (a+c)^2 + c^2}{2c}.$$

Also from PD and PE we get $M = N + z^2 - t^2$. Now let $\angle PBD = \theta$ and $\angle PBE = \varphi$. Then

$$\cos \theta = \frac{z}{\sqrt{N+z^2}}, \sin \theta = \frac{N^{\frac{1}{2}}}{\sqrt{N+z^2}}, \cos \varphi = \frac{t}{\sqrt{N+z^2}}, \sin \varphi = \frac{M^{\frac{1}{2}}}{\sqrt{N+z^2}}.$$

Hence $\cos(\theta + \varphi) = \frac{tz - N^{\frac{1}{2}}M^{\frac{1}{2}}}{N + z^2} = \cos B = \frac{a^2 + c^2 - b^2}{2ac} = \frac{1}{8} \dots (1)$. Substi-

tuting the value M and reducing, we find

$$63N^2 + 2(31z^2 - 32t^2 + 8zt)N = x^2(8t + z)^2 \dots (2).$$

Solving this quadratic in N , we find $N = l^2 - 12325 = 1290.142857$, hence $l = 116.7$ feet.

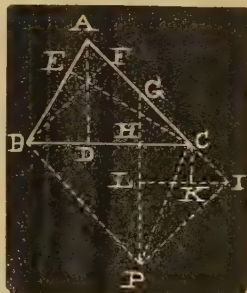
By A. L. FOOTE, Merrick, N. Y.

Let ABC , having side $AB = 40$, $AC = 50$, and $BC = 60$ feet, be the triangle, and the tower at $A = 90$, at $B = 100$, and at $C = 110$ feet. Let fall on BC from A the perpendicular AD , and also from C and B the perpendiculars CE and BF on AB and AC , respectively.

Let $DC = x$ and $BD = 60 - x$, and we have $AC^2 - CD^2 = AB^2 - BD^2$, or $50^2 - x^2 = 40^2 - (60 - x)^2$; whence $x = 37\frac{1}{2}$ feet $= CD$, and $BD = 22\frac{1}{2}$ feet. In like manner we find BE

$= 33\frac{3}{4}$ feet, and $AE = 6\frac{1}{4}$ feet; also, $CF = 45$ feet and $AF = 5$ ft.

Now, to find a point, H , in BC equidistant from the tops of the towers at B and C , we have, by denoting the distance from the foot of the tower at C to said point by x_1 , and from B to said point by $60 - x_1$, $110^2 + x_1^2 = 100^2 + (60 - x_1)^2$; whence $x_1 = 12\frac{1}{2}$ feet $= CH$, and $BH = 47\frac{1}{2}$ feet. Likewise we find the point, I , in AC produced which is equidistant from the tops of the towers at A and C , and $AI = 65$ feet and $CI = 15$ feet. Since the point, H , in BC is equidistant from the tops of the towers at B and C , then will, also, every point in the perpendicular GHP through BC at H , be equidistant from their tops. In like manner it may be shown that every point in the perpendicular IP is equidistant from the tops of the towers at A and C . It now follows that the point of intersection of these perpendiculars at P is equidistant from the tops of the three towers, and is the position of the foot of the ladder.

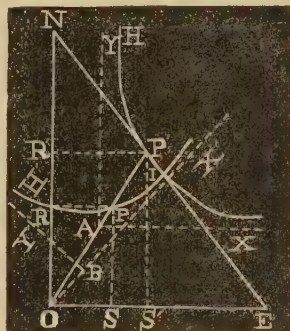


Draw IL parallel to BC , and CK parallel to GP , and join PC . Having AC and DC , we find $AD = 12\frac{1}{2}\sqrt{7}$. By the similar triangles ADC and CKI , we find $IK = 11\frac{1}{4}$, $CK = 3\frac{3}{4}\sqrt{7}$, and $LI = IK + CH = 23\frac{3}{4}$ feet. Also, in the similar triangles ADC and ILP , we have $AD : DC :: IL : LP$, whence $LP = \frac{285}{2}\sqrt{7}$, and $PH = LP + CK = 19\frac{5}{4}\sqrt{7}$. Then $\sqrt{[(\frac{195}{4}\sqrt{7})^2 + (12\frac{1}{2})^2 + (110)^2]} = 116.680316 +$ feet must be the length of the ladder.

899. Victor was riding with his father through the country. They stopped to rest under the shade of a tree. A village lay directly north of them and another directly east. After leaving the tree they rode 30 miles in a course 35° east of north, and then were equidistant from the two villages. After riding 15 miles farther in the same direction, they were in a direct line with the villages. Now Victor is a young mathematician and wishes to know how many contributors to the *Visitor* can tell him how far apart the two villages are, and how far from each they were when under the tree.

By A. F. PARSONS, Arroyo Grande, Cal.

CONSTRUCTION. — Let O be the tree, N and E the villages, P and P' points from which observations were taken. Bisect OP' in A and from A draw AY and AX parallel to ON and OE . Through P' describe an equilateral hyperbola with AY and AX for asymptotes. This hyperbola will be the locus of the centers of all lines passing thro' P' , and their extremities in ON and OE , (Eddy's Geometry, Page). Draw PR perpendicular to ON , and through the



point of its bisection draw a parallel to ON cutting OX' the bisector of NOE in B . Erect BY' perpendicular to OX' . Describe through P an equilateral hyperbola with asymptotes BY' , BX' . It will be the locus of the feet of perpendiculars from P on the centers of all lines having their extremities in ON and OE (Eddy's Geom., p.). $\therefore$ the intersection I of these hyperbolas is a point in the hypotenuse of the required triangle.

CALCULATION. — Let $x = OE$, $y = ON$, $a = OP'$, $b = OP$ and $\varphi = \angle NOP'$. Then $OR = b \cos \varphi$, $OR' = a \cos \varphi$, $OS = b \sin \varphi$, $OS' = a \sin \varphi$. Then $NR' : R'P' :: NO : OE$, or $y - a \cos \varphi : a \sin \varphi :: y : x$. $\therefore$

$$x = \frac{ay \sin \varphi}{y - a \cos \varphi} \dots (1),$$

$$\text{and } NR^2 + RP^2 = SE^2 + SP^2, \text{ or } (y - b \cos \varphi)^2 + (b \sin \varphi)^2 = (x - b \sin \varphi)^2 + (b \cos \varphi)^2 \dots (2).$$

Combining these equations and reducing we get

$$x^3 - [2(a+b)\sin\varphi]x^2 + [3ab - \cos 2\varphi(a+b)]x - 2a^2b\sin\varphi = 0 \dots (3).$$

(This equation will give either side, x or y , by taking $\varphi = 35^\circ$ or $\varphi = 55^\circ$. In the latter case $\cos 2\varphi$ is $-$, and the second term of the coefficient of x will be added). Introducing the numerals

$$x^3 - 86.037x^2 + 2895.6825x - 68689.970 = 0,$$

$$y^3 - 122.8725x^2 + 5204.3175x - 99526.725 = 0.$$

Therefore $x = 56.2693$, $y = 67.7285$, and $\sqrt{(x^2 + y^2)} = 88.109$.

By W. J. HUSSEY, Mendon, Ohio.

Draw HE and ID perpendicular to AC , and EF and DG to AB . Then $AH = EF = 45\sin 55^\circ = 36.8619$, $AI = DG = 30\sin 55^\circ = 24.5746$, $AF = HE = 45\sin 35^\circ = 25.8109$, and $AG = ID = 30\sin 35^\circ = 17.2073$. Also, $IH = 12.2873$ and $FG = 8.6036$.

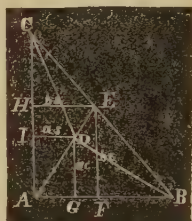
Let $x = CH$ and $y = BF$, and since $\triangle s CEH$ and EFB are similar, $xy = HE \cdot FE \dots (1)$.

Since $CD = BD$, $(CH + IH)^2 + ID^2 = (BF + FG)^2 + GD^2$,
or $(x + IH)^2 + ID^2 = (y + FG)^2 + GD^2 = [(HE \cdot EF) \div x + FG]^2 + GD^2$,
or $x^4 + 2IHx^3 + (IH^2 + ID^2 - FG^2 - GD^2)x^2$

$$- 2HE \cdot EF \cdot FGx - HE^2 \cdot EF^2 = 0 \dots (2).$$

Substituting the values of IH , ID , FG , GD , HE and EF , given above, we get $x^4 + 24.5746x^3 - 231.3438x^2 - 1642.53x - 905240 = 0$, whence by Horner's method $x = 31.075$ and from (1), $y = 30.617$. The distance to east village from tree is $AB = AF + y = 56.428$ mi.; to north village $AC = AH + x = 67.937$ mi.; and the distance between the villages is $BC = \sqrt{(AB^2 + AC^2)} = 88.31$.

NOTE.—The above diagram illustrates Mr. Davison's solution p. 163, August Visitor.



List of Contributors to this Number.

HENRY GUNDER, *North Manchester, Ind.*, solved all from 903 to 911.

A. L. FOOTE, *Merrick, N. Y.*, 905, 906, 907, 909, 910.

PROF. DEVOLSON WOOD, *Hoboken, N. J.*, 904.

WM. WILEY, *Detroit, Mich.*, 905, 906, 908, 909, 910.

R. A. LEISY, *Burton City, Ohio*, 906, 909.

DR. S. P. BARTLETT, *E. Dixfield, Me.*, 906, 910.

A. M. SCRIPTURE, *Clinton, N. Y.*, 906, 908, 909, 910.

B. F. FINKEL, *Amanda, Ohio*, 906, 907, 909.

J. C. GREGG, *Brazil, Ind.*, 906, 907, 908, 909.

A. N. SYMMES, *Lewisburgh, Ohio*, 906.

W. J. KAUFFMAN, *Marshallville, Ohio*, 906, 909.

GEO. L. SHANER, *Stewart's Station, Pa.*, 906.

D. S. POND, *Rochester, Ohio*, 909, 910.

Problems for Solution.

923. If $\frac{1}{3}$ of 6 were 3, what would $\frac{1}{2}$ of 6 be? If 3 were $\frac{1}{2}$ of 6, what would $\frac{1}{3}$ of 6 be?

J. K. ELLWOOD.

924. If I start from Detroit, Lat. $42^{\circ}20' N.$, Long. $83^{\circ} W.$, in a southeasterly direction, and pursue that course on the arc of a great circle, where shall I strike the Equator?

WM. WILEY.

925. I have four grades of wheat worth 75, 80, 90, and 95 cents per bushel, respectively. How must I mix the grades so that I may sell 900 bushels of the mixtures at \$1.02, on 3 months time, when money is worth 8%, and still make a present gain of 20%?

EDITOR.

926. Divide a given quadrant into two equal parts by a line at an angle φ with one of the bounding radii.

A. F. PARSONS.

927. A circular excavation was made for a water works, 74 feet in diameter and 20 feet deep, when it was found necessary for the center of the excavation to be 20 ft. further to one side; how many more cu. yd. of dirt would have to be removed?

J. R. BALDWIN.

928. The sum of the squares of the diagonals of any trapezoid is equal to the sum of the squares of the unparallel sides plus twice the rectangle of the parallel sides.

J. W. PFEIFFER.

929. Three men carry a triangular plank weighing 300 lbs., 18 ft. long and 4 ft. wide at the base. How far from the larger end must a handspike be put parallel with the base, so that two men at the handspike may carry $\frac{2}{3}$ of the entire weight, the third man being at the apex?

B. F. FINKEL.

930. A pole 100 feet high stands in water 10 feet deep. The pole breaking, the top, without falling off the stump, falls into the water leaving 25 feet between it and the stump at the surface of the water. What is the height of the stump?

A. M. SCRIPTURE.

931. The diagonal of a square field is 20.71 chains longer than one of its sides. Find area, arithmetically, algebraically, geometrically.

C. F. YOUNG.

932. If G be the point of intersection of the medians of a triangle ABC , and M any other point whatever in the plane of the triangle, then we shall have $MA^2 + MB^2 + MC^2 = AG^2 + BG^2 + CG^2 + 3MG^2$.

COOPER D. SCHMITT.

933. Considering that the English alphabet has 21 consonants and 5 vowels, how many words can be formed having three consonants and one vowel in each?

D. W. K. MARTIN.

934. A quantity of air at a temperature of $15.6^{\circ} C.$, has a volume of 4 cu. ft. under a pressure of 12 lbs. to the square inch. What will be its volume at a temperature of $48.7^{\circ} C.$, under 14 lbs. to the square inch?

J. B. SANDERS.

935. To divide the circumference of a circle into four equal parts by aid of the dividers only.

L. A. MATHIAS.

936. Find a triangle such that the sides and the perpendiculars from each angle to the opposite side shall be integral.

J. C. ROEBUCK.

937. Bought a tract of land, the length of which is to the width as 8 is to 5; the price per acre in dollars is the same as the number representing the length in rods. The number of dollars paid for the land equals 13 times the number of rods around it. Required, the length and width.

R. A. LEISY.

938. From a point in latitude λ ($=41^{\circ}19'$) three horizontal lines are drawn, one due north, one due east, and one exactly northeast. What rate of change in the absolute direction of each of these lines is caused by the earth's rotation?

COLMAN BANCROFT.

939. It is required to bisect a quadrilateral by a line drawn from one of its angles.

H. A. WOOD.

Solutions by Oct. 1. Use diagrams to illustrate, if desirable. Be accurate.

ENGLISH GRAMMAR.

Answers to Queries.

1. Parse—He is *worth* him and all his connections. *I cannot give.*
JOHN TODD, *Red Level, Ala.*

ANS.—*Worth* is a predicate adjective, referring to the subject *he*. *Can not* should not be written together, as *can* is an auxiliary of *give*, and *not* an adverb, modifying *can give*.

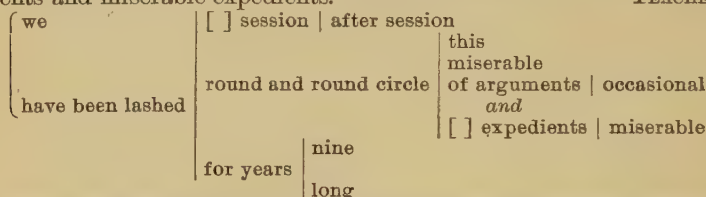
2. Is it correct to say, "Neither of them are remarkable for precision" ? *Id.*

ANS.—This idiom has been justified by the usage of some good writers, but in strict grammar the verb *are* should be *is* to agree with its singular subject.

3. Show how we came by the possessive case in 's. *Id.*

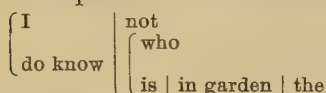
ANS.—From the Anglo-Saxon genitive case in *ys* or *es* we have the possessive case in 's—the apostrophe being used to denote the elision of the vowel. The affix for the genitive case employed in A. S., is one which it has in common with nearly all the Aryan languages.

4. Diagram—For nine long years, session after session, we have been lashed round and round this miserable circle of occasional arguments and miserable expedients. *TEACHER.*



Round and round is a compound preposition, and a preposition understood governs *session*.

5. Dispose of "I do not know who is in the garden." *Id.*



The substantive clause, *who is in the garden*, is the object of *do know*. *Who* is an indefinite interrogative pronoun.

6. Form derivatives from the bases, *rode*, *cur*, *fix*, *lumine* and *pose*, using the prefixes *ad*, *cum*, *in*, *ob* and *sub*. *APPLICANT.*

ANS.—*Ad* means to, and placed before *fix* takes the form of *af* as *affix*. *Cum* signifies *with*, and takes the form of *cor* in *corrode*. *In* changes to *il* in *illumine*. *Ob*, meaning *against*, is the prefix in *occur*. *Sub* (*under*), in the form of *sup*, gives *suppose*.

7. Should the teacher follow the author in class exercises and in the disposition of disputed points ? *A. J. GARST.*

ANS.—To avoid confusion, we think it best to follow the text-book, unless the class is prepared to study grammar critically, when it would be interesting to discuss the points of variance among authors. If your class has Harvey, dispose of words and sentences accordingly.

Examination Questions.

By request we shall hereafter publish all the lists of questions used by our State Board of Examiners. Below we give part of the July list, the remainder next month. We like the Grammar so well that complete answers are given, which will be valuable to students of the English language. D. W. K. Martin, of this county, secured a state certificate on this list. He will be principal of the Ft. Recovery schools this year. Next state examination during Holidays. Please change "Sept. 4," last line on page 203, to Aug. 7. The date was misplaced. September list will be published next month.

ARITHMETIC.

1. State the principle upon which the rule for finding the least common multiple is founded.

ANS.—That the least common multiple of several numbers is the product of the greatest number of different prime factors contained in the numbers.

2. What are the values of the units of measure used in the metric system?

ANS.—The unit of length is the *meter* = 39.37 in. Unit of surface is the *are* = 3.9574 sq. rd. Unit of volume for wood is the *stere*, 3.6 of which make a cord. Unit of capacity is the *liter* = 61.027 cu. in. Unit of weight is the *gram* = 15.432 Troy ounces.

3. What per cent of \$.005 is \$50?

ANS.—The rate is $50 \times 100 \div .005 = 1,000,000\%$.

4. What is the compound interest of \$200 for 1 yr. 8 mo. 15 da., at 6 %, payable semi-annually?

ANS.—We get \$21.28 for the compound interest.

5. Yesterday at noon my longitude was $16^{\circ} 18'$ west; to-day the sun was on the meridian at 11:36 A. M. What was my longitude?

ANS.—Difference of time is 24', and difference of longitude is 6° . Hence the required longitude is $10^{\circ} 18'$.

6. If railroad stock be yielding 6% and is 20% below par, how much would have to be invested to give an income of \$390?

ANS.—The face of stock is $\$390 \div .06 = \6500 , and costs $\$6500 \times .80 = \5200 .

7. A park 10 rd. square is surrounded by a drive which occupies $\frac{1}{10}$ of the whole park; what is the width of the drive?

ANS.—The space inside of the drive is $\frac{81}{100}$ of the whole area, and its side is $\sqrt{\frac{81}{100}} = \frac{9}{10}$ of 10 = 9 rd. Hence, the drive is $(10 - 9) \div 2 = \frac{1}{2}$ rd. wide.

8. The present worth of a debt is \$660, which is \$13.20 less than the debt; if money is worth 6%, how long before the debt is due?

ANS.—The discount on the present worth for 1 month is $660 \times .06 \div 12 = \3.30 ; the time is $13.20 \div 3.30 = 4$ months.

9. What is the length of the longest measure that will be contained an integral number of times in $18\frac{2}{3}$ ft. and $57\frac{1}{2}$ ft.

ANS.—The G. C. D. of the $18\frac{2}{3}$ and $57\frac{1}{2}$ is $2\frac{3}{10}$, which is the measure in feet.

10. What time between 5 and 6 o'clock will the hour-hand be midway between the figure 5 and the minute-hand?

Ans.—At 5 o'clock the minute-hand is at XII. and the hour-hand at V. At the required time the hour-hand has moved a certain distance, say 1 *distance*, from V., and by the conditions the minute-hand must move 25 minute-spaces + two distances. But while the hour-hand moves 1 *distance*, the minute-hand will move 12 *distances*; therefore 12 *distances* = 25 minute-spaces + 2 *distances*, or 10 *distances* = 25 minute-spaces, and 1 *distance* = $2\frac{1}{2}$ minute-spaces, the distance the hour-hand has moved, and $2\frac{1}{2} \times 12 = 30$ minute-spaces, is the distance moved by the minute-hand. The time is 30 minutes past five o'clock.

GRAMMAR.

1. Is the English a composite language? If so, state the elements. Which one constitutes the "blood and soul" of our language?

Ans.—It is a composite language, historically developed by the introduction of the following elements:

The *Celtic Element* came from the Celts, who were the earliest inhabitants of Great Britain, and it is known that Britain was inhabited before the Trojan war, over 1200 years B. C. The Celtic family embraces two branches, the Cambrian or Cymric and the Gaelic. The dialects of the former are, 1. The Welsh in Wales; 2. The Cornish in Cornwall; 3. The American of Bas Bretagne. Gaelic dialects are, 1. The Irish Gaelic of Ireland, or the Erse; 2. The Scotch Gaelic of the Highlands; 3. The Manx of the Isle of Man. The names of nearly all the mountains, lakes and rivers of both British islands have their origin in some Celtic language.

The *Latin Element* was introduced after the conquest of Britain, invaded by Julius Cæsar in 55 B. C., and the conquest completed by Agricola. Roman dress, language and literature spread among the natives, and as the Latin was spoken by the authorities, by missionaries, and by Roman colonies, we can readily see how the language of the ancient Britons was somewhat modified by the introduction of Latin words and phrases. Thus *strata* is changed into *street*; *colonia* into *coln*, as in *Lincoln* = *Lindi colonia*; *castra* into *chester* and *cester*, as *Winchester*, *Gloucester*, (originally written *Glevæ Castra*). Cæsar held possession of Britain about 500 years.

The *Anglo-saxon Element*, the "blood and soul" of our language, was introduced after the Romans retired from the island. The Britons were not able, after their long subjugation, to defend themselves against the Picts and Scots, who now poured in upon them from the northern part of the island. Vortigern, the most powerful of the British kings in A. D. 449, invited the Saxons, Hengist and Horsa, with their followers, to fight his battles.

"Then sad relief, from the bleak coast that hears
The German Ocean roar, deep-blooming, strong,
And yellow-haired, the blue-eyed Saxon came."

The term *Saxon*, derived from a short, crooked sword, called *seax*, which those warriors carried under their loose garments, was generally applied to the adventurers led by those chieftains, though they belonged to three tribes; viz., the Angles, the Saxons, and the Jutes, all of whom belonged to the Gothic race, and who composed the second great stream issuing from Asia and spreading over the northern and western part of Europe. They belonged to the Teutonic or Germanic branch, which occupied the part of Europe which the Germans and Danes now occupy. The *Jutes* in 449, came from Jutland, in Denmark, and occupied small possessions in Kent and the Isle of Wight. The *Saxons* came from the wide country south of Denmark. The *South Saxons* established themselves in Sussex, A. D. 491; the *West Saxons* in Hampshire, 519; and the *East Saxons* in Essex, 527. The *Angles* came from Anglen in Sleswick, Denmark, and in 527 located in East Anglia, Norfolk, in Bernicia, Northumberland, and in Derby, Yorkshire. These called their section *Angleland*, which was afterwards contracted to *England*. After the Britons were subjugated, the West Saxons grew in power and territory until 827, when Egbert, King of Wessex, made all the other Saxon kings tributary. The most distinguished of the West Saxon kings was Alfred, whose taste for letters drew learned men from abroad

into England, and by important literary effort the West Saxon language became the cultivated language of the Anglo-Saxons. The Anglo-Saxon enters largely into our language, about $\frac{1}{3}$ of the words in actual use being from this element; but we do not like *element* here, for the Anglo-Saxon being the backbone, blood and soul of our language, ought to be known as the *mother tongue* of the English.

The *Danish Element* was introduced by the Northmen, including Norwegians, Danes and Swedes, who spoke the same language, differing only in dialect. They commenced their aggressions upon England in 787, and for three centuries were the terror of the Anglo-Saxons. They finally yielded to the line of Saxon kings through Edward the Confessor. Many traces of this language can be found in Northern England.

The *Anglo-Norman Element* came from the Norman French, a language spoken in the northern parts of France. It is composed of three elements, the *Celtic*, the *Latin*, and the *Scandinavian*. The latter was introduced by Rollo, a Norwegian chieftain and the Northmen who settled in Normandy. When the Roman empire was mistress of the world, the Latin language was spoken more or less through the empire. Out of the union of the Latin with other languages spoken, grew six principal dialects which are now called languages; two eastern, the *Italian* and *Wallachian*; two southern, *Spanish* and *Portuguese*; and two north-western, the *Norman French* and the *Provençal*. In 1066, William, duke of Normandy, invaded England with an army of 60,000 men, and at the battle of Hastings killed Harold the king and defeated his army, and thus put an end to the Anglo-Saxon dynasty. After he ascended the throne he adopted the Jeffersonian policy, "To the victors belong the spoils." The Norman French, as a consequence, was spoken by the superior class of society in England nearly three centuries, from the Conquest to the time of Edward III., 1327. The laws, proceedings of Parliament, and all official reports were in the French language. In the statutes of Oriel College, Oxford, there is a regulation, so late as 1328, that the students shall converse together, if not in Latin, at least in French.

2. What modifications took place after and through the battle of Hastings in our vocabulary? What influences infused the English with Latinisms? With Anglo-Saxon? Compare them in merit.

Ans.—A great number of Latin words were introduced, first by monks, and since by learned men, especially terms relating to theology and science generally. Many of them are changed in form, in accordance either with Norman or with English analogies, when received from the Norman-French or Roman authors. The other questions are answered above.

3. Why is the English language destined to grow more rapidly than any other?

Ans.—Because it is a medium language and is well adapted to diffusion. In the Gothic family it stands midway between the Teutonic and the Scandinavian branches. Hence a German or a Dane finds much in English which exists in his own, and we need not be surprised that he takes up English so readily. By the bonds of consanguinity our language unites the Romanic with the Gothic languages. Hence an Italian or a Frenchman delights in the familiar words he finds with us, though the basis of the English is Gothic. Thus it is adapted to spread among the races that speak these languages, in Europe and America. Under such circumstances and being fixed in the national literature of the two greatest nations on the globe, we think the day will come when all parts of the world will listen to the English language as to a voice of power, and accept it as the universal language.

4. Is the phonetic reform a modern craze? What effect, if any, would the striking out of silent letters have on etymological research? On pronunciation? Is grammar the result of constituted conventions or the creature of unconscious growth? Why?

ANS.—It is, indeed, a *modern craze*, and if it is should prevail we would lose the means by which the origin of words is often determined (by silent letters), and in the pronunciation of certain words as *note* and *not*, *hate* and *hat*, etc., there would be some difficulty.

Grammar is a growth, because the free use of speech can not be tied down by the rules of the grammarian. All he can do is to formulate the current uses of his time, which are determined by habit and custom, and are accordingly in a perpetual state of flux.

5. Discuss the infinitive at length.

COMMENT.—We desire to give our readers the benefit of the best and fullest discussion possible. The answer to this question will appear in a future issue.

6. Explain the different uses of *shall* and *will*.

ANS.—To avoid speaking presumptuously of the uncertain future and to observe good breeding in the manifestations of our will, we are required to use *shall* and *will* with great care in order to speak with becoming propriety. Cobbett was mistaken when he said, "The use of *shall* and *will* are as well known to us as all the uses of our teeth and noses." The great difficulty lies in the fact that these words perform the duty of three German words, *werden*, *wollen* and *sollen*.

ETHICAL USE. Case 1. *Werden* indicates mere futurity, and when *shall* and *will* are thus used, politeness refers the future acts of others to their own will, and prevents us from referring our own acts to our own will. Hence *shall* is used in the first person and *will* in the second and third. In the first person plural we sometimes say *we will consent* when prominence is given to self (*I* and somebody else), which is an exception to the general rule.

POTENTIAL USE. *Wollen* and *sollen*. Case 2. Here *will* is used in the first person, and indicates determination or submission. The use of *shall* in the second and third implies either a command, an obligation, or a physical necessity.

INTERROGATIVE USE. Case 3. If the querist is supposed to answer his own questions with courtesy, we have these forms: *Shall I?* I shall. *Shalt thou?* Thou wilt. *Will he?* He will. But when the answer comes from another person, the forms are: *thou wilt*, *I shall* and *he will*, respectively. When the will of the person addressed is called for in the way of a promise or determination, then we have the following: *Shall I?* Thou shalt. *Wilt thou?* I will. *Shall he?* He shall. The expression, *Will I?* is used when the querist calls in question his own will.

CONTINGENT USE. Case 4. When the conceptions of the speaker only are implied, then contingent expressions require the exclusive use of *shall*; as, *If I shall consent*. But when there is a contingency in volition, *will* is used; as, *I may consent, if I will*, *You can if you will*, and *If you will consent, I will employ the teacher*.

PROPHETIC USE. Case 5. All through the Bible we have examples of the sacred use of *shall*; as, "When the Son of Man *shall* come," "Then *shall* the King say," "Thou *shalt* guide me with thy counsel," and "Surely goodness and mercy *shall* follow me." This use of *shall* is not that of resolution as in Case 1, but is that of foreknowledge or of complete faith.

7. Give syntax of italicized words:

(Scene from *Hamlet*.)

Bern. *Who's there?*

Fran. *Nay*, answer me; stand and unfold yourself.

Bern. Long live the *King*.

Fran. *Bernardo?*

Bern. *He*.

Fran. You come most carefully upon your honor.

Bern. 'Tis now *struck* twelve; get thee to bed, Francisco.

Fran. For this relief much *thanks*; 'tis bitter cold and I am sick at heart.

Bern. Have you had a quiet guard?

Fran. *Not a mouse stirring.*

Analyze:

Bern. Well, good night.

If you do meet Horatio and Marcellus,

The rivals of my watch, bid them make haste.

Ans.—*Who's* = *who is* has no difficulties. The intransitive verb *is* agrees with the interrogative pronoun *who* in person and number. *Nay* is an adverb, used independently. *King* is a proper noun, subject of the verb *live*. *Bernado* is a proper noun in the predicate with *are* understood. Are you *Bernado*? I am *he*. *He* is a personal pronoun, in the predicate with *am* understood. 'Tis = *it is*, and *it* is the subject of *is*. *Struck* is the perfect participle of *strike*, and belongs to *twelve*; or part of the verb, *It has now struck twelve*. *Thanks* is a common noun, object of a verb understood (*give* perhaps). *Not a* is an adjective, belonging to *mouse*; or *not* is an adverb, modifying [*was*] *stirring*. *Stirring* is a verb, auxiliary *was* understood, and agrees with its subject *mouse*. The analysis in the last is easy, and we omit it.

GEOGRAPHY.

1. Name five states that border on the Ohio river and locate the largest city in each.
2. Name the five most populous countries of Europe bordering on the Mediterranean sea and its tributaries and the largest city in each.
3. Where is Ulster? What religion prevails there? Name the most important seaport in England, France, Germany.
4. Name the two most populous countries of Asia and state the race to which the people respectively belong.
5. How do degrees of latitude vary in length and why?
6. Define ecliptic, summer solstice, winter solstice, vernal and autumnal equinox.
7. In what direction does the tide wave move? Why?
8. How much later does the tide take place each day? Why?
9. Give two proofs of the earth's oblateness.
10. What is the difference in the construction and use of a thermometer and barometer? How can they be used to determine the heights of mountains?

GENERAL HISTORY.

1. Name the eighteen decisive battles of the world. Give the cause and result of twelve of this number.

CIVIL GOVERNMENT.

1. What is the object of civil government?
2. Name and describe the three forms of Colonial government.
3. State the leading points of the ordinance of 1787.
4. Distinction in detail between the Articles of Confederation and the Constitution.
5. Name ten distinct powers belonging to Congress.
6. Compare Gladstone's Home Rule for Ireland with our form of government.
7. Remedy for Anarchism. Communism. Capital and labor.
8. State the manner of election of the President of the U. S. Can you suggest an improvement on this?

9. How are cabinet officers chosen? Name the present members. How many departments were there under Washington? Which have since been created? Why should the United States Commissioner of Education be a member of the Cabinet?

10. What advantages has a republic over a monarchy? A monarchy over a republic? In what direction are nearly all forms of government of civilized nations tending? Why?

PEDAGOGY.

1. 2. Illustrate your method of conducting a primary language lesson.

3. Outline a first year's course in teaching numbers.

4. What is the proper use of the text-book in teaching history.

5. Discuss the doctrine that learning is self-teaching. How may children be best led to make their own investigations?

6. Give your opinion as to the propriety of teaching physiology in common schools, and state how this branch should be taught.

7. Who was Pestalozzi? Froebel? Rousseau? Locke?

8. Define induction, and give its applications in teaching.

9. What important changes in the Ohio school law have been made within the last two years?

10. What constitutes a complete equipment for the teacher?

Optional: Give the order of the unfolding of the mental faculties.

ORTHOGRAPHY.

1. Name some of the chief difficulties in English orthography.

2. What method do you prefer in teaching spelling? Give a reason for your answer.

3. Write words containing a diphthong, a digraph and a trigraph.

4. What is meant by the vocabulary of a language?

5. What is meant by the derivation of words? Give an example.

6. In general, what classes of words are of Anglo-Saxon origin?

7. Give two rules for spelling. Illustrate.

8. What are suffixes? Give examples.

DARKE COUNTY LIST.

ORTHOGRAPHY.

1. How many sounds are represented by the letters in the alphabet?
ANS.—About 42.

2. What are the principal organs of speech?
ANS.—Lips, teeth, tongue, palate and glottis.

3. What is the power of a letter?
ANS.—Its elementary sound.

4. What does the prefix *mis* mean? Form ten words using the prefix *mis*.

ANS.—*Mis* is an Anglo-Saxon prefix, signifying *wrong*. Examples.—Misspell, missent, misplace, misrule, miscall, misstep, mistake, misteach, mistime and misuse.

5. What does the suffix *ly* mean? Form ten words using the suffix *ly*.

ANS.—*Ly*, meaning *like* or *resembling*, is an abbreviation from the Anglo-Saxon *lic*.

6. Define simple, compound and derivative words.

ANS.—See text-book.

7. How many sounds has the letter *a*? What diacritical marks indicate each sound?

ANS.—See dictionary.

GEOGRAPHY.

1. Name five of the most noted plateaus in the world.

ANS.—Thibet, Auvergne, Abyssinia, Great Basin and Mexico.

2. Of what does the British Isles consist? The British Empire?

ANS.—England, Scotland and Ireland. Great Britain and all its possessions.

3. Distinguish between an absolute and a limited monarchy, and name two of each.

ANS.—An absolute monarchy is a government in which the will of the sovereign is not restricted by a constitution, and a limited one is thus restricted. Turkey and Russia and Great Britain and Germany are good examples.

4. Of what does the German Empire consist? Name four of the most noted Kingdoms of the Empire, with their capitals.

ANS.—It consists of kingdoms, grand duchies, duchies, principalities and free towns. It has only four kingdoms Prussia, Bavaria, Saxony and Wurtemberg. See p. 41, Vol. 6, for names of all the above classes.

5. Name five of the most noted rivers of Africa and tell where each empties.

ANS.—Nile, Niger, Zambezi, Congo and the Orange.

6. Locate and account for the zone of calms.

7. Name the seas in and around Europe.

ANS.—Fifteen may be given. Eleven all know, and besides we know the Ionian, the Tyrrhenian, the Ligurian and the Candian.

8. Give the area and population of the United States.

ANS.—Area over 3,602,000 sq. mi., including water surface. Population over 52,000,000 at present.

9. Name five of the leading agricultural states of the Union. Which state produces the most gold and which the most silver?

ANS.—Taking the approximate value of the crops in the states in 1883 as the basis, we have Ill., \$169,000,000; New York, \$129,000,000; Iowa, \$120,000,000; Pennsylvania, \$114,000,000; Ohio, \$112,000,000. California has produced about \$1,200,000,000 worth of gold bullion and Nevada about \$300,000,000 worth of silver bullion.

10. Name the territories of the United States with their respective capitals.

ANS.—See text-book.

ARITHMETIC.

1. A merchant sold corn at the rate of 75 bu. for \$30, and thereby lost 20%; what per cent. would he have gained had he sold at the rate of 64 bu. for \$48?

ANS.—One bushel cost $(\$32 \div 75) \div .80 = \$.50$, and was sold for $\$48 \div 64 = .75$; hence $(75 - 50) \times 100 \div 50 = 50\%$, gain.

2. Divide one hundred and forty-seven tenths by one thousand and twenty-eight thousandths.

Ans.—We have $14.7 \div 1.028 = 14.29961 +$.

3. A and B are partners; A's stock is to B's as 4 to 5; after 3 mos. A withdraws $\frac{2}{3}$ of his, and B $\frac{3}{4}$ of his; divide their year's gain, \$1675.

Ans.—Let 4 shares be A's stock and 5 shares B's stock. A's investment is the same as $(4 \times 3) + (1\frac{2}{3} \times 9) = 24$ shares for 1 month and B's $(5 \times 3) + (1\frac{1}{4} \times 9) = 26\frac{1}{4}$ shares for 1 month; hence their gain must be divided in proportion of 24 and $26\frac{1}{4}$ or as 32 and 35, and A gets \$800, B, \$875.

4. The length of a certain house is 35 ft., the breadth is 25 ft., the height to the eaves is 20 ft., and to the ridge 30 ft. Without allowing the roof to project, what will it cost to shingle it at \$6 per 100 square feet?

Ans.—The width of one side of the roof is the hypotenuse of a right-angled triangle whose base is $25 \div 2$, or $12\frac{1}{2}$ feet, and perpendicular $30 - 20 = 10$ feet, which we find to be $\sqrt{(12\frac{1}{2})^2 + 10^2} = 1\frac{1}{2}\sqrt{41} = 16.0078105 +$ feet. The cost is $35 \times 16.0078105 \times 2 \times .06 = \67.23 .

5. I sell certain stock for \$4,920; one-half of it at 10% premium, the balance at 5% discount. What is the par value of the stock?

Ans.—I realize $(110 + 95) \div 2 = 102\frac{1}{2}\%$ of the face of the stock in the entire sale, and $4920 \div 1.02\frac{1}{2} = \4800 , is the value required.

6. A brewer has a circular floor, the diameter of which is 30 ft., surrounded by a granary 4 ft. wide and 3 ft. high; how many bushels of barley will the granary contain?

Ans.—Area of granary floor is $\pi(22^2 - 18^2) = 19584\pi$; and the capacity in cu. in. is $19584\pi \times 36 = 705024\pi$; the number of cu. in. in a Winchester bushel is $18\frac{1}{2} \times \frac{1}{4} \pi \times 8 = 684\frac{1}{2}\pi$; hence we have $705024\pi \div 684\frac{1}{2}\pi = 1029\frac{33}{65}$ bu.

7. I sent my agent at Cincinnati a draft for \$1,000 to buy a safe, commission $2\frac{1}{2}\%$; he takes the draft to bank and has it cashed at $\frac{1}{4}\%$ discount; what should the safe cost that the draft may cover all?

Ans.—The safe costs $\$1000 \times .99\frac{1}{4} \div 1.02\frac{1}{2} = \973.17 .

8. A's gain is \$1800, B's \$2250, C's \$3200; A's capital was invested for 6 mos., B's for 9 mos., and C's for 16 mos.; how much of the capital, \$27,450, did each own?

Ans.—Their monthly gains are \$300, \$250 and \$200, respectively, and their investments are in the same proportion, or as 6, 5 and 4; hence A gets \$10980, B, \$9150 and C, \$7320.

9. It takes 6,720 rails to fence a 40-acre farm (in the form of a square) so that each field contains 10 acres; how many rails will it take to fence 160 acres (same form) into fields of 40 acres each?

Ans.—Since the large farm and its fields are respectively similar to the small farm and its fields, with areas as 4 to 1, it is easily seen that it will take $\sqrt{4} = 2$ times the number of rails to fence the large farm, or 13440.

10. If the door of a room is four feet wide, and is opened to the angle of 90° , through what distance has the outer edge of the door passed?

Ans.—Any point in the outer edge of the door will describe $\frac{90}{360} = \frac{1}{4}$ of the circumference of a circle whose diameter is $4 \times 2 = 8$ ft.; hence $\frac{1}{4}$ of $8 \times 3.1416 = 6.2832$ ft.

GRAMMAR.

1. Decline *thou, it, bird, himself*.

Ans.—Thou, thy, thee; you, your, you. It, its, it; they, their, them. Bird, bird's, bird; birds, birds', birds. Himself, themselves.

2. What different elements may be formed by a preposition and its object? Illustrate by examples.

Ans.—Adjective and adverbial;—as, *The pupils of our school recite in eight branches.*

3. What different elements may be formed by infinitives? Illustrate.

Ans.—Essential; as, *To die is to live.* Adjective; as, *Let him go.* Adverb; as, *Try to succeed.* Attendant; as, *To tell the truth, I was mistaken.*

4. What is a preposition? What do you understand by the antecedent term of relation? What part of speech may it be?

Ans.—The antecedent term of relation is modified by the phrase, and may be a noun, pronoun, verb, or participle.

5. Give the principal parts of *run, lie, lay, grow, shave*.

Ans.—Run, ran, run. Lie, lay, lain. Lay, laid, laid. Grow, grew, grown. Shave, shaved, shaven.

6. What is a passive verb? How formed? Give examples.

ANS.—A verb in the passive voice represents the subject as acted upon, and formed by using the verb *to be* or one of its inflections with the perfect participle; as, The teacher was observed.

7. Write a synopsis of *catch*, indicative mode, both voices.

ANS.—I catch, I am caught; I have caught, I have been caught; I had caught, I had been caught; I shall catch, I shall be caught; I shall have caught, I shall have been caught.

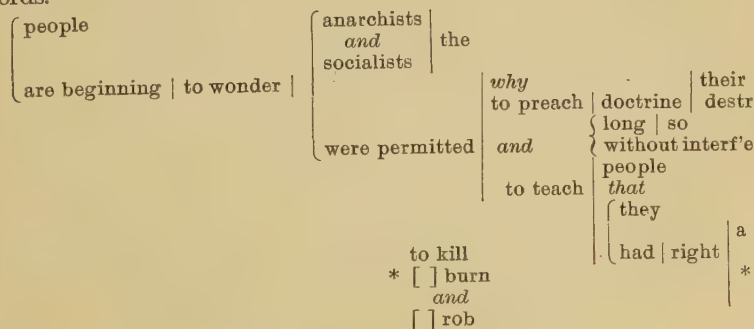
8. Conjugate *give* in the potential mode, active voice.

Ans.—See text-book.

9. What is an idiom?

Ans.—An idiom is, 1. A form of expression peculiar to a language. 2. A dialect, (Greek *idios*, meaning *peculiar*). See p. 185, Vol. 6.

10. Diagram and parse—People are beginning *to wonder why* the anarchists and socialists *were permitted to preach* their destructive doctrine *and to teach people that they had a right to kill, rob and burn, so long without interference.* Diagram 10 and parse italicized words.



HISTORY.

1. When and where did the First Continental Congress meet? State the action of that body.

Ans.—The first Continental or General Congress met at Carpenter's Hall, Phila., Sept. 4, 1774. Delegates from eleven colonies organized by choosing Peyton Randolph president and Chas. Thompson secretary, Mr. Thompson was not a member, but by his eminent fitness he held that office 15 years, until the dissolution of that Congress. He was a resident of Phila. After some hesitation in proposing business, Patrick Henry made an opening speech, in which his eloquence was powerful and gave inspiration for all their subsequent deliberations. Each colony was to have one vote. They agreed upon a declaration of rights, resolved that commerce with Great Britain should be closed, sent a petition to the king, an address to the British people, and a memorial to the Canadians. It was in session 8 weeks, and the delegates from N. C. came Sept. 14. The British minister, Mr. Pitt, thus spoke of the work of this Congress: "I have read Thucydides and have studied and admired the master statesmen of the world, but for solidity of reasoning, force of sagacity, and wisdom of conclusion, under such complication of circumstances, no nation or body of men can stand in preference to the General Congress at Philadelphia."

2. When were the stars and stripes adopted as the emblem of our country?

Ans.—June 14, 1777, and Mrs. Ross, who lived on Arch st., Phila., in a house still standing, made the first flag of this design. For many years she carried on the business, supplying nearly all the flags in the country. Paul Jones first unfurled this flag upon the *Ranger*.

3. Describe the founding of Plymouth Colony.

Ans.—Before the Pilgrims landed the celebrated compact of civil liberty was framed and signed in the cabin of the *Mayflower* by the forty-one male adults whose names you have in this issue, p. 206. It reads as follows:

"In the name of God, amen. We, whose names are underwritten, the loyal subjects of our dread sovereign lord King James by the grace of God, of Great Britain, France and Ireland, King, Defender of the Faith, etc., having undertaken for the glory of God and the advancement of the Christian faith and honor of our King and country, a voyage to plant the first colony in the northern parts of Virginia, do by these presents solemnly and mutually in the presence of God and one another, covenant and combine ourselves together into a civil body politic for our better ordering and preservation, and furtherance of the ends aforesaid; and by virtue hereof to enact, constitute and frame such just and equal laws, ordinances, acts, constitutions and offices from time to time as shall be thought most meet and convenient for the general good of the colony; unto which we promise all due submission and obedience. In witness whereof we have hereunder subscribed our names at Cape Cod this 11th day of Nov. in the year of the reign of our sovereign lord, King James of England, France and Ireland, the eighteenth, and of Scotland the fifty-fourth, Anno Domini 1620." Under this compact John Carver was chosen governor and Miles Standish, military captain. They landed on Plymouth Rock, Dec. 21, 1620, and at once began a settlement. Mary Chilton's foot, it is said, first touched the rock. Oceanus Hopkins was born at sea and Peregrine White was born during their stay at Cape Cod, about Nov. 27.

4. State the action of the Hartford Convention.

Ans.—It made a report of its secret deliberations to the legislatures of Mass., R. I., Conn., N. H., and Vt. through the delegates from these states, recommending several amendments to the constitution. Several expressions used in connection with its secrecy, were attended with evil impressions on the coun-

try at large, and the federal party in whose feelings the convention had its origin, suffered criticism for suggested disruption of the Union. The convention met Dec. 15, 1814, and lasted three weeks.

5. What is meant by a President's veto? What President has been noted for exerting his veto powers?

Ans.—The President's veto, (Latin *veto*, I forbid), is the statement of his objections to a bill. Pres. Cleveland.

6. Give date and place of the first settlement in Ohio. Name her first governor. Locate her first capital. Give date of her admission. When was the capital located at Columbus?

Ans.—The first British settlement was on the Miami River, about a hundred miles from its mouth, then called *Pickawillany*, now Loramie's Store, made in 1751. The French, however, destroyed it in 1752, and took the English traders to Canada. But the first permanent settlement was made at Marietta, April 7, 1788, (p. 106). St. Clair was the first governor (p. 223, Vol. 6). Admitted Nov. 29, 1802. Chillicothe succeeded Cincinnati as the capital of the N. W. Territory in 1800, and the next year the stone state house was erected in which the territorial legislature held its first session in 1801. The convention that framed the constitution of Ohio met in it, and the state legislature held its sessions there from April, 1803, till 1810, when Zanesville claimed it, having erected a building for the purpose and being confident of getting the permanent state capital, the location of which was then in the hands of five commissioners. The legislature met at Zanesville in its sessions of 1810-11 and 1811-12. In the meantime the spot where Columbus now is was selected. The capital was again removed to Chillicothe, and in the fall of 1816, it was permanently removed to Columbus.

7. What naval officer opposed Perry on Lake Erie? What general opposed Meade at Gettysburgh? Grant at Shiloh? Jackson at New Orleans? Taylor at Buena Vista?

Ans.—Commodore Barclay, a veteran who had fought under that British naval hero and admiral of the first order, Lord Horatio Nelson, at the Nile and Trafalgar, and who had already lost an arm in the service of his country. But Oliver H. Perry, a native of R. I. and then in his 28th year, who had never seen a naval battle, gained that great victory. Lee opposed Meade; Johnston, Grant; Packenham, Jackson; and Santa Anna, Taylor.

8. Sketch Morgan's Raid.

Ans.—In June and July, 1863, the famous guerrilla chief, with 4000 mounted and armed men, made a raid through Ohio and Indiana, plundering and ravaging all he could. But the Home Guards soon environed his movements, and he and the remnant of his forces were captured at New Lisbon, Ohio, by Col. Shackelford. He escaped from the Columbus prison and fled to Richmond where he was appointed major-general and stationed in southwestern Virginia.

9. Account for the Whisky Rebellion.

Ans.—The people of Western Pennsylvania claimed it was unjust for the government to lay a tax on distilled liquors and require a small portion of country to pay a tax on something not produced elsewhere; and that their grain could not be disposed of, except to the distillers. See Vol. 6, p. 125, and Vol. 5, p. 169.

10. When and by whom was the doctrine of Popular Sovereignty introduced? Define its meaning.

Ans.—On pp. 105-6, of current volume.

NOTE.—The foregoing list was used at Greenville, Sept. 4.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

481. Why is it that queen bees can not be made from eggs over five days old?
A. N. SYMMES, *Lewisburgh, Ohio.*

Ans.—Because as soon as the larva is hatched from the egg, which under proper temperature takes three days, it must be fed by a rich stimulating food called "royal jelly," so as to accelerate its growth and the formation of its organs, especially the ovaries. In five days the larva will then be ready for its cocoon. If fed on the partially digested and milder food for workers, no queen can be raised. A worker is an imperfect female. All eggs matured in the queen's ovaries are of the same kind, and when laid by an unimpregnated queen, or without coming in contact with the spermatheca held in a receptacle opening in the oviduct, drones only can be hatched. There have been instances where weak queens have been reared, from eggs in worker cells, by enlarging the cell, and feeding the stimulating food soon after the exclusion of the larva.

EDITOR.

1061. Is the story of John Smith and Pocahontas true or fabulous?

L. M. ORLADY.

Ans.—It is pronounced a myth by good authorities, and from the circumstances connected with the supposed scene, it is likely the case.

EDITOR.

1062. Three men carry a log 12 feet long. One takes hold at one end, where must the other two place a hand-spike that each may support $\frac{1}{3}$ of the whole weight?
GEO. W. SHAFER, *Arcanum, Ohio.*

Ans.—The handspike must be placed 3 feet from the end. Because the center of gravity of the log is 6 feet from the end, and in order that each may sustain $\frac{1}{3}$ of the weight, the one at the end must be *twice* as far from the center of gravity as the two with handspike.

EDITOR.

1063. Who killed Tecumseh?

NOAH H. WARE.

Ans.—It is generally conceded that Col. Richard Mentor Johnson, ninth Vice President of the United States, killed Tecumseh while dangerously wounded, in the celebrated battle of the Thames, near Detroit, Oct 5, 1813. Tecumseh was a Brigadier General in the British army, commanding a body of Red Men.

1064. "But Congress may, by a vote of two-thirds of both houses, remove such disability." Are we to understand that an affirmative is required?

M. A. BROWN.

Ans.—Yes, sir. The noun *vote* in this case signifies a *wish*.

EDITOR.

1065. What healthful advantages, if any, are gained by sleeping with the head to the north?
JOHN YOUNG, *Packerton, Pa.*

Ans.—We do not think that the magnetic current around the earth has any preference as to the position of our bodies during repose.

EDITOR.

1066. Is matter composed of molecules and atoms?
Id.

Ans.—Molecules and atoms. An atom is a component part of a molecule.

990. Trace the International Date-Line, as it now exists.

L. G. KUHN.

Ans.—The line passing from Behring's strait along the coast of Asia and west of the Philippine Islands, thence in a curve around the north of New Guinea, through Chatham Island to the Antarctic Ocean, is not regarded at

present. The Philippine Islands have adopted eastern time, and the change is now made in the Pacific Ocean near the 180th meridian, except on the Aleutian Islands, and others of Oceanica belonging to nations on the Western Continent.

EDITOR.

991. When and by whom was the Type-Revolving Press invented?

Id.

Ans.—By Robt. Hoe in 1827. In 1837, Richard M., son of Robert, invented the double cylinder press. In 1846 he invented his famous rotary press, which is the basis of all the letter presses. Presses made on this plan were capable of printing 25,000 copies in an hour; but the rotary is now largely superseded by the web perfecting press, the greatest of all Col. Hoe's works. B. S. DAVIS.

992. In whose reign was the "Parliament of Paris" established?

H. A. WOOD.

Ans.—The foundation of the Parliament of Paris is ascribed to Louis VII. about the middle of the 12th century. It was at first a court of justice which accompanied the king wherever he went, till Philip the Fair fixed it at Paris by an ordinance dated March 23, 1302.

WM. S. DAVIDSON.

993. When was the silk worm introduced into Europe?

Id.

Ans.—Two Persian monks who had been residents in China, and who had become acquainted with the mode of rearing the silk-worm, being encouraged by promise of gifts from Justinian, succeeded about the year 550 in carrying eggs of the insect to Constantinople where they were by them nourished and fed, and thus the silk-worm was introduced into Europe.

A. L. FOOTE.

The web of the silk-worm found its way into Greece during the time of Aristotle, through the Phœnicians and Persians, but the cultivation in Europe of the worm itself did not occur until 530 A. D. when, according to Procopius, the eggs were brought from India (China) to the Emperor Justinian by some monks.

W. T. HELLMAN.

994. Name the seven wise men of Greece.

G. W. SCHAEFFER.

Ans.—The Seven Wise Men of Greece, distinguished for their practical sagacity and wise maxims on the principles of life, flourished in Greece in the sixth century, B. C. Their names were Solon, Chilo, Pittacus, Bias, Periander, (in place of whom some give Epimenides), Cleobulus and Thales.

ED. RYNEARSON.

The Seven Wise Men of Greece were variously named. The following Grecian doggerel gives one version.

I'll tell the names and sayings and the places of their birth,
Of the seven great ancient sages so renowned on Grecian earth.
The Lindian Cleobulus said, "The man was still the best";
The Spartan Chilo, "Know thyself"; a heaven-born phrase confessed;
Corinthian Periander taught, "Our anger to command";
"Too much of nothing," Pittacus of Mitylene's strand;
Athenian Solon this advised, "Look to the end of life";
And Bias from Priene showed, "Bad men are most rife";
Milerian Thales urged that "None should e'er a surety be";
Few were these words, but, if you look, you'll much in little see.

The above is found on p. 601, Barnes's Brief General History, the best self-instructing history extant.

W. T. HELLMAN.

Homer, Lycurgus, Pythagoras, Solon, Socrates, Plato and Aristotle.

A. L. FOOTE.

995. How was coal discovered?

Id.

Ans.—The earliest record of coal in this country is by Hennepin in his *New Discovery of a Vast Country in America* (London 1698), in which he alludes to "cole-mines" along the Illinois River. He evidently refers to beds of coal appearing on the surface, and not to mines. The first coal-working in America

was in the Richmond (Va.) coal-field about 1750. In 1775 and during the Revolution this fuel was used at the Richmond forges in making arms and ammunition for the American army. It was quarried from banks exposed to daylight. Nobody knows how and where coal was first discovered. EDITOR.

996. Locate four post-offices, whose names contain two letters each.

Id.

Ans.—I find there are twelve such offices, and one with one letter only.

At, Cleburne Co., Ala. *Q. K.*, Tunica Co., Miss.. *Re*, Navarro Co., Texas.
At, Fulton Co., Ohio. *O. K.*, Lancaster Co. S.C. *T. B.*, Pr. Geo.'s Co., Md.
At, Putnam Co., Tenn. *O. K.*, Lincoln Co., Ky. *Ur*, Marion Co., Ala.
Ka., Dallas Co., Texas. *O. Z.*, El Paso Co., Col. *Y-Z*, Grainger Co., Tenn.
 I also found a post-office in Tippecanoe Co., Ind., whose name is *B*.

W. C. BINKLEY.

997. Name some standard authors on Physiognomy. On Mesmerism?

W. C. L.

Ans.—The founder of Physiognomy and a man of wonderful characteristics, was John Casper Lavater, born at Zurich, in 1741, and at the capture of Zurich by Massena, in September, 1799, he was shot on the street by a soldier. He suffered over a year from the wound and died in 1801. Friedrich Anton Mesmer was the founder of Mesmerism, born at Meersburgh, in Suabia, 1733. He died in Germany in 1815.

A. L. MENDENHALL.

S. R. Wells of the *Phrenological Journal*, New York, wrote a large work on Physiognomy, and John B. Newman, M. D., and John Bovee Dods, on Mesmerism, published by the same company.

EDITOR.

999. Who have written under the following pseudonyms: *Eli Perkins*, *Gath*, *Peter Pindar*, *Sam Slick* and *Teufelsdröckh*? D. W. K.

Ans.—Melville D. Landon, an American humorous writer, as *Eli Perkins*; George Alfred Townsend, a noted journalist, as *Gath*; John Wolcott, an English physician and satiric poet, as *Peter Pindar*; Thomas Chandler Haliburton, a humorous and popular English author, as *Sam Slick*; and a certain gentleman not a thousand miles from here, who wrote for a local newspaper, as *Teufelsdröckh*.

EDITOR.

Gath, in Dryden's *Absalom and Achitophel*, means Brussels, where Charles II. ("David") resided while in exile. *Peter Pindar* the assumed name of John Wolcott and C. F. Lawler. *Sam Slick*, the name of a clock-maker of Slickville and the pretended author of various works written by Thomas Chandler Haliburton. *Teufelsdröckh*, "Devil's dung," the name of the imaginary author of Carlyle's *Sartor Resartus*, who is represented as devoting his lofty genius to the sublime "Philosophy of Clothes."

A. L. FOOTE.

1000. Give the names of the "Pilgrim Fathers" that came in the *Mayflower*.

A. P. PRAKEL.

Ans.—The names of the male passengers who landed at Plymouth 265 years ago from the *Mayflower* are as follows:

Isaac Allerton, John Alden, John Allerton, Wm. Bradford, Wm. Brewster, John Billington, Peter Brown, Richard Britterage, John Carver, Francis Cook, James Chilton, John Crackston, Richard Clarke, Edward Doty, Francis Eaton, Thomas English, Samuel Fuller, Edward Fuller, Moses Gletcher, John Goodman, Richard Gardiner, John Howland, Stephen Hopkins, Edward Leister, Christopher Martin, Wm. Mullins, Edmund Margeson, Degony Priest, Thomas Rogers, John Rigdale, Miles Standish, George Soule, Edward Tilly, John Tilly, Thomas Tinker, John Turner, Edward Winslow, William White, Richard Warren, Thomas Williams, Gilbert Winslow.

The servants named were Carter, Coper, Ely, Holbeck, Hooke, Langemore, Latham, Minter, More, Prower, Samson, Story, Thompson, Trevore, Wilder.

WM. S. DAVIDSON.

1001. Give a sketch of Parker Cleaveland,

Id.

ANS.—He was an eminent American mineralogist, born in Massachusetts in 1780, graduated at Harvard in 1799, and from 1805 till his death in 1858, he was professor of chemistry, mineralogy, etc., in Bowdoin College, Me. His excellent work on Mineralogy and Geology introduced him to the friendly notice of Davy, Cuvier and other illustrious scientific men, and he became a member of the principal scientific associations in Europe. EDITOR.

1002. What noted statesman and infidel said that the Bible is the germ of musk which has perfumed all Europe? B. S. D.

ANS.—Talleyrand, Prince of Benevento, the most subtle, shrewd and unprincipled of modern diplomatists. See *Pulpit Treasury*, Vol. 4, No. 1.

B. S. DAVIS.

1003. What meridians has Congress adopted for nautical and astronomical purposes? B. F. FINKEL.

ANS.—The meridians of Greenwich Observatory, and of the Naval Observatory at Washington. All calculations for Part I. of the American Ephemeris are referred to the first meridian, and for Part II. to the second.

PROF. WILLIAM HOOVER, *Athens, Ohio.*

1004. Explain why a plumb-line, if prolonged, would not pass through the center of the earth, except at the equator or poles. M. C.

ANS.—A meridian section of the earth is an ellipse—a curve such that the sum of the distances from a point in it to two given fixed points, called the foci, is constant. A plumb line at any point of the earth's surface is at right angles to the tangent at that point, and bisects the angle included by the distances from the point of tangency to the foci. The foci are on opposite sides of the center of the curve and at equal distances from it. From the nature of the plane triangle, the bisector passes through the center only when it is perpendicular to the line joining the foci, or coincides with it; and by the properties of the ellipse, the plumb line or bisector then takes the direction of the minor and major axes of the earth; which *a fortiori* answers the query.

WILLIAM HOOVER.

1005. Locate the national homes for U. S. soldiers and sailors.

ANS.—An act of Congress was passed in 1851 for the founding of such homes, when temporary asylums were established, the principal and only permanent "Home" for the regular army being in the District of Columbia. In 1873 "Homes" for volunteers were established at Augusta, Me., Dayton, Ohio, and Milwaukee, Wis.

S. B. KECKLER.

List of Contributors to this Number.

A. L. MENDENHALL, *West Manchester, Ohio*, 993, 994, 1005.

W. T. HIELMAN, *Gratis, Ohio*, 990, 992, 1005.

H. G. THOMAS, *German, Ohio*, 994, 1000, 1003, 1005.

EVA N. MILLER, *Gordonsville, Minn.*, 996, 999.

S. B. KECKLER, *Weaver's, Ohio*, 990, 994, 999.

B. S. DAVIS, *Gordon, Ohio*, 994, 996.

ED. RYNEARSON, *Gettysburg, Ohio*, 991, 993, 996.

WM. S. DAVIDSON, *Lewisburg, Ohio*, 990, 991, 994.

W. C. BINKLEY, *Cincinnati, Ohio*, 992.

A. L. FOOTE, *Merriek, N. Y.*, 991, 992.

Querists.—JNO. YOUNG, *Packerton, Pa.*; PROF. DEVOLSON WOOD, *Hoboken, N. J.*; WARREN LOY, *Pyrmont, Ohio*; C. W. BRUMBAUGH, *German, O.*; JULIUS A. SHEETS, *Calvary, Va.*; NOAH A. WARE, *West Manchester, Ohio*; M. A. BROWN, *German, Ohio*; L. M. ORLADY, *McConnellstown, Pa.*

QUERIES.

1029. Who was the first colored voter in the United States? What is stamped on both sides of the medal he wears? JOHN YOUNG.

1030. Who possesses the pen with which President Cleveland signed the Blair Bill recently? *Id.*

1031. What special training in oratory had Henry Clay? L. B.

1032. How many perfect squares can be formed, using the nine digits in each number? *Id.*

1033. Give a brief description of Wayne's treaty with the Indians at Greenville, naming the different tribes and chiefs. B. S. D.

1034. Give Proctor's theory of the formation of comets. K. T. D.

1035. What fish goes a-fishing with rod, line and bait? *Id.*

1036. How do spiders fly in the air? S. A.

1037. Give the natural history of the wood worm. *Id.*

1038. Why do the signs of the subtrahend change? SUBSCRIBER.

1039. Describe the plant called *Alfalfa*. Where found? *Id.*

1040. Which is the oldest railroad in Ohio? *Id.*

1041. To what pressure must water be subjected to prevent it from freezing at 25° Fah.? DEVLSON WOOD.

1042. Who was Toscanelli? Give biography. AMPHIC.

1043. What and where were the mines of Hispaniola to which De-Ayllon had intended to take his kidnapped Indians? *Id.*

1044. Whence come our buttons, cork and sponges? LAURA.

1045. How is the substance called *Lac* produced? *Id.*

1046. Give the origin of names of our leading fabrics. *Id.*

1047. What new theories did Darwin the scientist produce? Give a sketch of his life and where buried. CURIOUS.

1048. To how many full moons is the sun's light equal? W. LOY.

1049. What was the "Property taken at the siege of Sevastopol"? C. W. BRUMBAUGH.

1050. Who were the leaders in the secession movement? JULIUS A. SHEETS.

1051. What form of government have the following countries: Nepal Bliotan, Mosquito Reserve? NOAH A. WARE.

1052. Who discovered the planet Vulcan? Describe it. *Id.*

1053. Give history of the War of the Roses. A. L. MENDENHALL.

1054. Why is the circular edge of the New Moon brighter than the other portion not illuminated? M. A. BROWN.

1055. What are the general rules for the so-called lightning method as applied to adding columns? L. M. ORLADY.

1056. What President was the adopted son of Robt. Morris? *Id.*

1057. Where is slate mostly quarried? How? TEACHER.

1058. How is Chicago supplied with water? *Id.*

1059. Give the present rulers of European countries. *Id.*

1060. Should music be taught in the common schools? A. T.

Answers should be received on or before Oct. 1. Write on one side of the paper only, and attach signature to each answer.



EDITED BY

JOHN S. ROYER.

VOL. VII.

OCTOBER, 1886.

No. 10.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

911. Equal weights of gold and silver are in value as 20 to 1, and equal volumes are in value as 1284 and 35. A certain volume is composed of equal weights of gold and silver. Find how many times more valuable the same volume would be were it composed of gold. J. A. ROACH, *Frontenac, Minn.*

By A. L. FOOTE, Merrick, N. Y.

Assume that there is one ounce of each, the gold worth \$20 and the silver \$1. Again, the cubic contents of silver necessary to be worth one dollar, $1284 \div 35 = \$36\frac{2}{5}$, to which add \$20, gives $\$56\frac{2}{5}$, value of mass of silver and gold. Therefore, its value is $56\frac{2}{5} \div 21 = 2\frac{51}{85}$ times as much.

By A. M. SCRIPTURE, Clinton, N. Y.

By the problem, a volume of silver which weighs as much as a given volume of gold, must be $1\frac{2}{3}\frac{4}{5} \div 20 = 1\frac{2}{15}$ times as large. Therefore, since the given volume has 2 units of weight and 21 units of value, and if the silver it contains were replaced by gold, there would be $1\frac{2}{15} + 1 = 1\frac{17}{15}$ units of weight and $1\frac{2}{15} \times 20 = 1\frac{8}{3}\frac{4}{5}$ units of value, which would be $1\frac{8}{3}\frac{4}{5} \div 21 = 2\frac{51}{85}$ times as much.

912. A delivered daily for a period of 42 days 4 letters more than on the previous day. The aggregate delivery for the last 18 days was the same as that for the first 24 days. How many letters did he deliver altogether? *Id.*

By J. W. WATSON, Middle Creek, Ohio.

Let a = the number delivered the first day, $d = 4$, $n = 42$, and $l = a + (n-1)d = a + 164$. Then $s = \frac{1}{2}n(a+l) = 21(2a+164) = 42a + 3444$, the whole number delivered. For the first 24 days, we have $l = a + 92$, and $s = 24a + 1104$. For the last 18 days, we have $a + 96$ = first term, $d = 4$, $n = 18$, and $l = a + 164$; $\therefore s = 18a +$

2340. By the conditions, $24a + 1104 = 18a = 2340$, whence $a = 206$, and $42a + 3444 = 12096$, the number required.

913. A sold goods which cost him \$300 to B at a certain rate of profit. B sold the goods to C at the same rate of profit. If C paid \$432 for the goods, what did B pay? Id.

By WM. WILEY, 86 Jefferson Ave., Detroit, Mich.

Let r = the rate of profit. Then A sold for $300(1+r)$ and B, for $300(1+r)^2 = 432$, or $(1+r)^2 = 1.44$. Extracting square root of both members of last equation, $1+r = 1.2$; hence $r = .2 = 20\%$.

By R. A. LEISY, Burton City, Ohio.

Put $x = 100\% +$ rate of gain. Then $300x = 432 \div x$, or $300x^2 = 432$, whence $x^2 = \frac{4}{3} \frac{3}{6}$, and $x = 120\%$, and the gain is 20% .

By J. E. GENSEMER, Marshallville, Ohio.

Let x = rate of profit. Then $300x + 300$ = what goods cost B, and $300x^2 + 600x + 300$ what C paid. Hence $300x^2 + 600x + 300 = 432$, or $x^2 + 2x = .44$; whence $x = .20 = 20\%$, and B paid $\$300 \times 1.20 = \360 .

By GEO. C. RUSSELL, Petaluma, Cal.

Let r = rate of profit; then $\$300(1+r)(1+r) = \432 , or $(1+r)^2 = 1.44$, and $(1+r) = 1.20$. B paid $\$300 \times 1.20 = \360 .

914. A wins 9 games out of 15 when playing against B, and 16 out of 25 when playing against C. How many games out of 118 should C win when playing against B? Id.

By JOSIAH H. DRUMMOND, Portland, Me.

Since A wins 9 to B 6, the skill of B is $\frac{2}{3}$ that of A; and in same manner we find C's skill is $\frac{9}{16}$ of A's. B's and C's skill are, therefore, as $\frac{2}{3}$ to $\frac{9}{16}$, or as 32 to 27, and C wins $\frac{27}{59}$ of the games with B, or 54 out of 118.

915. A tinner makes two similar rectangular oil cans whose inside dimensions are as 3, 7 and 11. The first holds 8 gallons and the second being larger requires four times as much tin as the other. What are the dimensions of the smaller and the contents of the larger? N. O. SMITH.

By W. C. BINKLEY, Cincinnati, Ohio.

In 8 gallons there are $8 \times 231 = 1848$ cu. in. Assuming the dimensions of the can to be 3, 7 and 11 in., then the contents would be $3 \times 7 \times 11 = 231$ cu. in. By similar solids, the ratio of the required dimensions to those assumed is $\sqrt[3]{(1848 \div 231)} = 2$; hence the dimensions are 6, 14 and 22 in., respectively. Since the second can requires 4 times as much tin, by similar surfaces, its dimensions are $\sqrt{4} = 2$ times the first. Hence its capacity is $2^3 = 8$ times that of the first, or $8 \times 8 = 64$ gal.

916. A cylindrical vessel one foot in diameter was $\frac{1}{2}$ full of water, and by dropping a ball into it the water rose to the brim; find solidity of ball. *Id.*

By C. W. THOMPSON, Kansas City, Mo.

Assuming that the ball is just submerged, it is plain that the volume of the ball is $\frac{2}{3}$ the volume of the cylinder. By Geometry we have volume of sphere $= \frac{4}{3}\pi R^3$ and volume of circumscribed cylinder, $\pi R^2 \times 2R = \frac{4}{3}\pi R^3$; hence volume of sphere is $\frac{2}{3}$ of the circumscribed cylinder. The diameter of the ball equals the diameter of the cylinder, and its solidity is $12^3 \times .5236 = 904.7808$ cu. in.

917. An agent sold flour for me. After deducting his commission, he invested the proceeds in bank stock at 4% discount. After selling the stock at 30% premium, he remitted balance due me, charging 4% commission in each transaction. What was my rate of gain on value of flour?

By J. W. WATSON, Middle Creek, Ohio.

Put 100% = value of flour and 96% = proceeds of first sale; $.96 \div 1.04 = 92\frac{4}{13}\%$, amount invested in bank stock; $.92\frac{4}{13} \div .96 = 96\frac{2}{13}\%$, face value of stock, and 130% of $96\frac{2}{13}\% = 125\%$, amount for which stock sells; 4% of 125% = 5% commission on last sale, and $125 - 5 = 120\%$ is the amount remitted. Hence rate of gain is $120 - 100 = 20\%$.

NOTE.—An agent's commission is usually reckoned on the amount of money received or expended; but brokerage (a broker's commission), is reckoned on the face value, because a broker simply makes a bargain for another party without having the goods in his possession. We understand that the agent actually handles the flour and stock.—EDITOR.

918. My agent sold corn at 2½% commission. After increasing the proceeds by \$8.20, I ordered him to purchase wheat at the same commission; after which wheat declining 5%, my whole loss was \$48. What was the value of the corn? *By Request.*

By W. C. BINKLEY, Cincinnati, Ohio.

Let 100% = value of corn. Then $97\frac{1}{2}\% =$ proceeds, and $97\frac{1}{2}\% + \$8.20 =$ amount to invest in wheat; $(97\frac{1}{2}\% + \$8.20) \div 1.02\frac{1}{2} = 95\frac{5}{11}\% + \8 , value of wheat; and $(97\frac{1}{2}\% + \$8.20) - (95\frac{5}{11}\% + \$8) = 2\frac{3}{11}\% + \$20$, commission on wheat. The loss in decline of wheat is 5% of $(95\frac{5}{11}\% + \$8) = 4\frac{3}{11}\% + \40 . Hence $2\frac{1}{2}\% + 2\frac{3}{11}\% + \$20 + 4\frac{3}{11}\% + \$40 = \48 , or $92\frac{6}{11}\% = \$47.40$, and 100% = \$492.

By GEO. C. RUSSELL, Petaluma, Cal.

He invested $\$8.20 \div 1.025 = \8.00 out of the \$8.20, and realized $\$8.00 \times .95 = \7.60 . The loss on \$8.20 is $\$8.20 - \$7.60 = \$60$, and the loss on the corn is $\$48.00 - \$60 = \$47.40$. In the two transactions he realized $(.975 \div 1.025) \times .95 = .90\frac{2}{11}$ and lost $.09\frac{2}{11}$; the value of the corn is $\$47.40 \div .90\frac{2}{11} = \492 .

919. A tailor bought 40 yd. of broadcloth $2\frac{1}{4}$ yd. wide. After sponging, it shrank $3\frac{1}{4}\%$ in length and $6\frac{1}{4}\%$ in width. He desires to know how many yards of flannel $1\frac{1}{4}$ yd. wide he must buy to line the broadcloth, provided the flannel will shrink $6\frac{1}{4}\%$ in length and $2\frac{1}{4}\%$ in width. Id.

By R. A. LEISY, Burton City, Ohio.

We have $40 \times 2\frac{1}{4} = 90$ sq. yd. of cloth, but by shrinkage it becomes $90 \times \frac{29}{30} \times \frac{15}{16} = \frac{26\frac{1}{2}}{16}$ sq. yd. One yard of the lining contains $1 \times 1\frac{1}{4} = 1\frac{1}{4}$ sq. yd., which reduces by shrinkage to $1\frac{1}{4} \times \frac{15}{16} \times \frac{29}{30} = \frac{58\frac{5}{8}}{12}$ sq. yd. Hence $\frac{26\frac{1}{2}}{16} \div \frac{58\frac{5}{8}}{12} = 71\frac{5}{8}$ yd. is the quantity of lining required.

920. A man pulls out the stumps in a field at the rate of 25 cents a piece and piles up the stones at 10 cents a score. One stump occupies him as long as 40 stones. He works 3 days and earns \$8, then goes on at the same rate of working and finishes the job in $3\frac{1}{2}$ days more, earning altogether \$20. How many stumps and stones were there in the field? EDITOR.

By WM. WILEY, Detroit, Mich.

Let m and n represent the stumps and stones that give an earning of \$8, and M and N those that give an earning of \$12. Then

$$25m + \frac{1}{2}n = 800, \text{ or } 50m + n = 1600 \dots (1);$$

and $25M + \frac{1}{2}N = 1200, \text{ or } 50M + N = 2400 \dots (A).$

Since one stump requires the time of 40 stones, the relative times may be represented by $40m + n$ and $40M + N$, so that

$$40m + n : 40M + N :: 3 : 3\frac{1}{2} :: 4 :: 5;$$

whence $200m + 5n = 160M + 4N \dots (2)$. Multiplying (1) by 5, $250m + 5n = 8000 \dots (3)$, and subtracting (2) from (3), we get $50m = 8000 - 160M - 4N$, or $160M + 4N + 50m = 8000 \dots (4)$. Multiplying (A) by 4, $200M + 4N = 9600 \dots (5)$, and subtracting (4) from (5), $40M - 50m = 1600$, or $4M = 5m + 160 \dots (6)$. We have four unknown quantities and only three equations; hence the problem is indeterminate. From (6), $M = \frac{1}{4}(5m + 160) \dots (7)$, an integer, and $\frac{1}{4}m$ must be an integer, say p . Then $m = 4p$. The lowest value assignable to p is 0, in which case $m = 0$. Substituting in (7), $M = 40$, and in (1), gives $n = 1600$; also M in (A), gives $N = 400$. The next higher value of p is 1, making $m = 4$, $n = 1400$, $M = 45$, and $N = 150$. The next value of m is 8, which makes $N = -100$, not admissible. As all succeeding values of N are negative, it shows that there can be but two combinations, making 0 stumps and 1600 stones to earn \$8 and 40 stumps and 400 stones to earn \$12, or 4 stumps and 1400 stones to earn \$8 and 45 stumps and 150 stones to earn \$12. Consequently, 40 stumps and 2000 stones or 49 stumps and 1550 stones will satisfy all the conditions.

By JOSIAH H. DRUMMOND, *Portland, Me.*

Let x = No. of stumps and y = No. of stones. Then

$$25x + \frac{1}{2}y = 2000, \text{ or } 50x + y = 4000 \dots (1),$$

whence $y = 4000 - 50x$. If $x = 1$, $y = 3950$, and it follows that x may vary from 1 to 79. Let v = time in minutes for one stone, and $40v$ = time for one stump (v can be taken in da., hrs., or sec.) Then $40vx + vy = 9720 (= 6\frac{3}{4} \text{ days}) \dots (2)$. Substituting value of y , and reducing, $x = 400 - 972 \div v$. Take $v = 972 \div m \dots (2)$; then $x = 400 - m$.

Let u = No. of stumps in 3 days and z = No. of stones in same time; then $25u + \frac{1}{2}z = 800$, or $50u + z = 1600 \dots (3)$, whence $z = 1600 - 50u$, where u may vary from 1 to 31. We have $40vu + vz = 4320$ (3 days). Substituting value of z , $u = 160 - 432 \div v$. Taking for v its value in (2), $u = 160 - \frac{4}{3}m$, or as u must be a whole number, taking $m = 9n$, we have $u = 160 - 4n \dots (4)$. As u can not be greater than 31, n can not be less than 33, and as u must be positive, n can not be greater than 39.

Let s = No. of stumps pulled in $3\frac{3}{4}$ days, and t = No. of stones in the same time. Then $25s + \frac{1}{2}t = 1200$, or $50s + t = 2400 \dots (5)$, whence $t = 2400 - 50s$, and $s = 1$ to 47 (limits). Again $40vs + vt = 5400$ ($3\frac{3}{4}$ days). Substituting as before, $s = 240 - 540 \div v = 240 - \frac{5}{3}m = 240 - 5n$.

From inspection, n can not be greater than 47, and as s can not be greater than 47, n can not be less than 39. Taking preceding condition, the only possible value of n is 39. $\therefore x = 400 - m = 400 - 9n = 49$ stumps, and $y = 4000 - 50x = 1550$ stones.

NOTE.—Can the reader see how n may have another value, 40, by which the other answer may be obtained?

By W. C. BINKLEY, *Cincinnati, Ohio.*

If he had worked stumps and stones in the same proportion the second period, he would have earned ($3:3\frac{3}{4}::8:10$) 10 dollars; hence he must have substituted stumps for stones to such an extent as to earn \$2 more, without increasing his rate of working. Every time he pulls a stump instead of picking 40 stones he gains 5 cents and to gain \$2 he must have substituted $200 \div 5 = 40$ stumps for $40 \times 40 = 1600$ stones. Now to make this possible, he must have picked at least 1600 stones (the equivalent for 40 stumps) the first 3 days, which brought him the \$8 at 10 cts. a score. If he picks 1600 stones in 3 days, in $3\frac{3}{4}$ days he would pick 2000; but for 1600 of these he substituted 40 stumps, hence there were 40 stumps and $1600 + 400 = 2000$ stones.

Again, suppose he pulled stumps only during the $3\frac{3}{4}$ days, which would be $1200 \div 25 = 48$ stumps, the same as 1920 stones, and at the same rate he would pick ($3\frac{3}{4}:3::1920:1516$) 1516 stones in 3 days. But 1516 stones are worth only \$7.58; hence he would have to pull $(8 - 7.58) \div .05 = 8.4$ stumps, which involves the absurd idea of a fractional stump. A trial with 47 stumps and 50 stones, and 46 stumps and 100 stones, both give fractional results. But 45 stumps and 150 stones produces 4 stumps and 1400 stones for the first 3 days; hence $45 + 4$, or 49 stumps and $1400 + 150$, or 1550 stones gives the other integral answer.

921. If A walk 9 hr. a day and B 8 hr. a day, and if, under like conditions, B walks 20% faster than A, how many days can A walk down hill a distance which B accomplished up hill in 5 days; supposing a man's rate is increased by $\frac{1}{5}$ in going down hill and decreased $\frac{1}{5}$ in going up? *Id.*

By A. L. FOOTE, Merrick, N. Y.

Since B walks 20% faster than A, their rates are as 5 to 6, and the distance gone by A in 9 hrs. may be represented by $9 \times 5 = 45$, and B in 8 hrs., by $8 \times 6 = 48$. Now B's distance on level ground in 5 days would be $5 \times 48 = 240$, but up hill it is $\frac{4}{5}$ of $240 = 192$. A in one day down hill goes $1\frac{1}{5} \times 45 = 60$, and to go 192 it will take him $192 \div 60 = 3$ days.

922. From an elevator wheat is running upon a floor at a uniform rate. After a certain quantity is on the floor, six men go to work and clear it in an hr.; but if ten men had been employed, the floor could have been cleared in half an hour. How long would it take four men? *Id.*

By A. M. SCRIPTURE, Clinton, N. Y.

If 10 men clear the floor in half an hour, 5 men can clear it in one hour, if no more wheat runs. But since 6 men are employed one hour, it takes one man one hour to clear what runs in half an hour. Therefore, 2 men clear the wheat as fast as it runs, and $10 - 2$, or 8 men clear a certain quantity in half an hour, but it will take $4 - 2$, or 2 men $\frac{8}{2} \times \frac{1}{2} = 2$ hrs.

By W. C. BINKLEY, Cincinnati, Ohio.

Suppose each man clears 10 bu. per hour. Then 6 men clear 60 bu. in an hour, and 10 men clear 50 bu. in half an hour; hence $60 - 50 = 10$ bu. run on in $1 - \frac{1}{2} = \frac{1}{2}$ hr., and $10 \times 2 = 20$ bu. run on in one hour. By this hypothesis there were $60 - 20 = 40$ bu. on floor when they commenced work, and since it requires 2 men to clear what is running on, when 4 men work there would be 2 men to clear the original 40 bu., which will require $40 \div (10 \times 2) = 2$ hrs.

Messrs. A. L. Foote, Josiah H. Drummond, George C. Russell, R. A. Leisy, W. C. Binkley and C. W. Thompson, solved all the problems from 911 to 922, inclusive. J. W. Watson, Wm. J. Kauffman and J. E. Gensemer, all except Nos. 911 and 920. Wm. Wiley, all except Nos. 917 and 918. A. M. Scripture all except Nos. 917, 919, 920, 921. J. W. Plants, *Philo, Ohio*, solved Prob. 918, and D. S. Pond, *Rochester, Ohio*, Nos. 912 and 916. We aimed to publish biographical sketches of those who solved all, but we had no new subjects. You will find the biographies of Messrs. Foote, Drummond, Russell and Leisy in Dec. No., 1885, and Messrs. Binkley's and Thompson's in June No. of this year. We shall give another list of problems soon for a similar purpose, when we shall publish sketches of the lives of S. G. Cagwin, Artemas Martin and others.

Hon. J. H. Drummond solved Prob. 920 in the court-room, while observing the progress of an important trial in which he was a chief counsel. We hope he may give us an *addendum*, showing, if possible, the other value of n . He said, "The problem is a very ingenious and pretty one, and it takes my fancy wonderfully." We can have but two answers, and the solutions published will be found very interesting.

ERRATA.—Page 163, 4th line of Mr. Davison's solution, first term of equation (2) should be $(y+as)^2$ instead of $(y+as^2)$. Mr. Davison's answers are correct. Prof. Wood's result on 1st page of last issue should be the same as Mr. Gunder's. Place t after $3M$ in numerator.

In this issue p. 210, 1st line, read $18a+2340$ instead of $18a=2340$.

Problems for Solution.

940. I marked goods to gain 60%, but on account of using an incorrect yard-stick, I gain only 40%; find length of measure. J. W. PLANTS.

941. An agent sells flour on commission of 2%, and purchases goods on true commission of 3%. If he had received 3% for selling and 2% for buying, his whole commission would have been \$5 more. Find the value of goods bought. *Id.*

942. A guardian was to pay to his wards \$31,000, with interest at 6% per annum, in five equal biennial installments. He loaned the money at 6% compound interest and paid off the installments as they came due; how much did he make by the transaction? What would have been the biennial installments, if he had loaned the money for the wards alone? C. W. THOMPSON.

943. A flask is filled with air at 0° , 760 mm. pressure, and sealed; it is then heated up to 200° ; what is the tension on the walls of the flask in units of atmospheric pressure? *By Request.*

944. To what temperature must a vessel be heated to drive out $\frac{1}{2}$ of the air it contains at 0° ? *Id.*

945. The angle of elevation of a tower is 45° , and on retiring 60 yards it is 30° , find the height of tower, if the angles are taken on a horizontal plane. *Id.*

946. Required, analytically, the equation of the hypocycloid when the radius of generating circle is $\frac{1}{2}$ of fixed circle. H. C. BICKEL.

947. Two poles, perpendicular to the same plane, are 30 feet and 50 feet in height. At what height from the plane will lines, drawn from the top of each to the base of the other, cross? L. A. M.

948. I have a barn 50 feet long and 25 feet wide, to one corner of which a horse is fastened by a rope 150 feet long. Over how much surface can the horse graze? *By Request.*

949. I can pick 50 bu. of potatoes or dig 25 bu., in a day. How many bu. can I dig and pick in 5 days? A. C. WARTHUM.

Solutions on or before Nov. 1. Write on one side of paper.

Examination Questions.

ARITHMETIC.

1. Define the following arithmetical terms: Axiom, demonstration, number, rule and problem.

2. (Four divided by $5\frac{1}{3}$) multiplied by 14 and one-seventh multiplied by ($2\frac{3}{4}$ divided by 4) multiplied by (5 divided by $7\frac{1}{3}$) multiplied by (1 and one-fifth divided by $2\frac{3}{4}$) multiplied by 6 equals what?

ANS.—We obtain $\frac{4}{5} \times 14\frac{1}{7} \times \frac{11}{22} \times \frac{12}{22} \times \frac{24}{24} \times 6 = 13\frac{5}{11}$.

3. $3\frac{5}{6}$ of $10\frac{9}{10}$ of what number, diminished by [three-tenths divided by (two and one-sixth plus seven thirtieths)], leaves twenty-five sixty-fourths?

ANS.—Performing necessary reductions, " $\frac{3}{8}$ of what number, diminished by $\frac{1}{6}$, leaves $\frac{25}{64}$." The number must be $(\frac{1}{6} + \frac{3}{8}) \div \frac{3}{8} = \frac{9}{8}$.

4. An 8 inch globe is covered with gilt at 8 cents per square inch; find the cost.

ANS.—The cost is $8^2 \times 3.1416 \times .08 = \16.08 .

5. Find the gain per cent. when stock is bought at 15 per cent. discount and 15 per cent. premium.

ANS.—Let 100% = par value, 85% = cost and 115% = selling price. Rate of gain is $30 \times 100 \div 85 = 35\frac{5}{7}\%$.

6. A traveller spent the first day, $\frac{1}{4}$ of his money; the second day, $\frac{1}{4}$ of the remainder, and so on the third and fourth days, when he had \$1.62 left; what sum had he at first?

ANS.—It is evident that $\$1.62 \div \frac{1}{4} = \2.16 , amount at beginning of last day; $\$2.16 \div \frac{1}{4} = \2.88 , at beginning of 3d day; $\$2.88 \div \frac{1}{4} = \3.84 , at the beginning of 2d day; and $\$3.84 \div \frac{1}{4} = \5.12 , at first. Or briefly, $\$1.62 \div \frac{1}{4} \div \frac{1}{4} \div \frac{1}{4} \div \frac{1}{4} = \5.12 .

7. Stock decreased $33\frac{1}{3}$ per cent., and again 20 per cent.; then it increased 20 per cent., and again $33\frac{1}{3}$ per cent.; the loss was \$66; find the value of the stock at first.

ANS.—The final value was $133\frac{1}{3}\%$ of 120% of 80% of $66\frac{2}{3}\% = 85\frac{1}{3}\%$; loss 100% — $85\frac{1}{3}\% = 14\frac{2}{3}\% = \66 ; $\therefore 100\% = \$450$, value at first.

8. If a bushel of wheat makes $39\frac{1}{2}$ pounds of flour and the cost of grinding be $\frac{1}{4}$ per cent., how many barrels of flour can a farmer get for 80 bushels of wheat?

ANS.—He will get $39\frac{1}{2} \times 80 \div 1.04 \div 196 = 15\frac{5}{8}$ bbl.

9. Sold 50 barrels of flour at \$5.25 per barrel and invested the proceeds in sugar, reserving my commissions, $\frac{1}{4}$ per cent. for selling and $1\frac{1}{2}$ per cent. for buying and the expense for shipping \$12; find amt invested in sugar.

ANS.—Net proceeds of flour are $(\$262.50 \times .96) - \$12 = \$240$; the value of sugar purchased is $\$240 \div 1.01\frac{1}{2} = \236.45 .

10. In a company of 90 persons there are 4 more men than women, and ten more children than men and women together; find number of each.

ANS.—The men and women = twice the number of women and 4 more; children = twice the number of women and 14 more; all are 4 times the number of women and 18 more; $\therefore (90 - 18) \div 4 = 18$ is the number of women. There were 22 men and 50 children.

GEOGRAPHY.

1. Name the political divisions of South America.

Ans.—See text-book and exclude Patagonia.

2. Of what does the solar system consist?

Ans.—The sun and the planets with their satellites.

3. Name the four largest of the Japan Islands.

Ans.—The main island is called *Nippon* in the older geographies, but by the Japanese themselves the name *Nippon* (Nippon) meaning *sun's origin*, is applied to the whole country, as it is that over which the sun first rises. The map in the Britannica from which we derive this answer, names the largest island *Hondo*. The next in size is *Kiushiu* (literally, *the nine provinces*), then in regular order *Shikoku*, (*the four provinces*), *Yezo*, *Sado*, *Tsushima*, *Hirado*, (often wrongly written *Firando*), *Awaji*, *Oshima*, *Iki*, and the *Oki*, *Goto*, *Bonin*, *Riukiu* (*Loochoo*), and *Kurile* groups. This constitutes the whole empire, the area of which has not been accurately determined.

4. What causes the change of seasons?

Ans.—The inclination of the earth's axis in conjunction with the revolution of the earth around the sun.

5. What is the position of the earth with reference to the sun on June 21st?

Ans.—The north pole is turned toward the sun and the sun's rays fall perpendicularly at the tropic of Cancer.

6. Name three movements of the sea. Describe each and state briefly the causes of each.

Ans.—Tides are a regular rising and falling of the sea, caused by the attraction of the sun and moon. Currents are streams in the sea, caused by the diurnal revolution of the earth, the difference in the temperature of the water and prevalent winds. Waves are caused by the wind.

7. What states border on the Atlantic Ocean?

Ans.—Me., N. H., Mass., R. I., Conn., N. Y., N. J., Del., Md., Va., N. C., S. C., Ga. and Fla.

8. Name the New England states and give the capital of each.

Ans.—Me., Augusta; N. H., Concord; Vt., Montpelier; Mass., Boston; R. I., Providence and Newport; and Conn., Hartford.

9. Name seven islands in the Mediterranean sea.

Ans.—Sicily, Corsica, Sardinia, Candia or Crete, Cyprus, Majorca, Minorca.

10. Bound Chili; give its capital and exports.

Ans.—It lies between the Pacific Ocean and the summit of the Andes from the Camarones River, lat. 19° 12' 30" S. to Cape Horn, in lat. 55° 59' S. The new boundary line made by treaty with Argentine Rep., Oct. 22, 1881, takes Cape Virgin on the Atlantic for a starting point, runs directly south to the Atlantic, thus taking all of Magellan Straits and most of Terra del Fuego; thence west to the summit of Mt. Aymon; thence along the northern shore of the Straits of Magellan to where it intercepts the 52d parallel in longitude 70° W.; thence the line follows the summit of the Andes to the river above mentioned. Area 300,000 sq. mi. Pop. in 1875, over 2,000,000, composed mostly of Germans, French, Argentines, English, Spaniards and Italians. It has 1100 miles of railroad and in 1880, 335 post-offices. The commerce is prosperous, and the country on account of its agricultural products and extraordinary mineral riches, is one of the great markets of the world. Exports wheat, flour, barley, wool, copper, silver and saltpetre. Imports sugar, cotton goods, hardware, machines, clothing, jewelry, etc.

HISTORY.

1. During the late rebellion how many and what states seceded?

Ans.—In full, p. 59.

2. What is the Mason & Dixon line?

Ans.—Full description p. 188, Vol 6.

3. Give an account of the Weather Department at Washington.

Ans.—The weather bureau was established by act of Congress Feb. 9, 1870. It provided for the taking of meteorological reports and the giving of storm signals by the war department. The secretary of war at once put it in the hands of Gen. Albert J. Myer. In 1872, the present system was organized, which now embraces every thing relating to changes of the weather and temperature, and millions of bulletins have been issued for the special benefit of commercial and agricultural interests of the country. Owing to the able work of Gen. Myer in building up the system he received the sobriquet of *Old Probabilities*. He was born at Newburgh, N. Y., Sept. 20, 1828, and died at Buffalo, Aug. 24, 1880. He graduated from Geneva College in 1847, and afterwards took a course of study in medicine.

4. Give a brief history of the Grangers.

Ans.—See p. 13.

5. What was the treaty of Ghent?

Ans.—See p. 170, Vol. 6.

6. Who were the V. Presidents with Abraham Lincoln?

Ans.—Hannibal Hamlin, of Me., and Andrew Johnson, of Tenn.

7. What is the Electoral College?

Ans.—See p. 196, Vol. 4.

8. What is the most important war in which the U. S. have ever been engaged?

Ans.—The Revolutionary War.

9. What V. President was elected by the U. S. Senate?

Ans.—See p. 39.

10. Give an account of our late trouble with Mexico.

Ans.—Francis Rasures, a naturalized citizen of the U. S. in Texas, was kidnapped and shot in Mexico last July by order of a Mexican rival in love, whose name is Mondagron, a chief of police. Rasures' pathetic letter to U. S. Consul Lynn to save him, was not delivered by the Mexican authorities till ten hours after its author was basely shot. This was the beginning of the trouble. A few days after, A. K. Cutting was arrested at Paso del Norte, a Mexican town across the river from El Paso, Texas, where Cutting published a paper and said some tough thing about a Mexican. He was imprisoned and asked Gov. Ireland of Texas for protection. Secretary Bayard demanded his release. He is now pardoned. It is said that Cutting's antecedents are not good, and that he learned type-setting at Clinton. Mich., married a Miss Haskin at Toledo, from whom he was divorced on account of drunkenness and neglect.

NOTE.—Since nearly all of our readers have full files of the *Visitor*, it is deemed expedient not to repeat answers. The references given will be sufficient, and valuable space saved. Full answers are given to all new and important questions. Every teacher in Darke county should have a full set of our magazine as all the lists used for seven years are found therein.

SPELLING.

Benzine, plateau, drainage, equinoctial, exceptions, pernicious, imbecile, spontaneous, curative, faucet, movable, bourgeois, deceptible, borough, impassible, waive, crucible, vaccinate, saucily, corollary.

GRAMMAR.

1. Define language, English grammar, syntax, participle and mode.

ANS.—Language, from the Latin *lingua*, the tongue, through the French word *langage*, speech, is the utterance of articulate sounds of the human voice for expressing the thoughts and emotions of the mind. These articulate sounds are signs of what is in the speaker's mind. Language is the spontaneous result of man's organization, and it grows with the growth of thought. As new ideas germinate in fertile minds, they often come forth in new forms of expression; new terms are applied to new things; and a language thus grows by grafts from without and by germs from within.

English Grammar, as a science, is a system of principles and a collection of facts peculiar to the English language; and, as an art, it is a system of rules for the proper application of these principles.

Syntax, from the Greek *syn*, with, and *taxis*, arrangement, treats of the arrangement and combination of words in sentences. Etymology deals with the forms of *single* words and Syntax with *groups* of words, and teaches how to combine the several parts of speech in sentences.

Participle, from the Latin *particeps*, partaking, is a verbal adjective, differing from other adjectives by carrying with it the idea of time. It is so called because it partakes of the nature of the verb.

Mode denotes those forms which the verb assumes to express the relation of reality or existence as conceived by the speaker. It shows the *manner*, Latin *modus*, in which an attribute is asserted of the subject.

2. How do you form the plural of nouns ending in *f* or *fe*, *o*, *y*, and of compound words?

ANS.—See Harvey's Grammar.

3. Write sentences containing the possessive plural of the following nouns and pronouns; *Child*, *I*, *woman*, *him* and *thief*.

ANS.—Our *children's* toys and the *women's* jewels were found in the *thieves'* den after they made *their* escape.

4. How do you determine the gender, number, person and case of a relative pronoun?

ANS.—The gender, person and number are determined by the antecedent, and the case by its construction.

5. Write all the infinitives and all the participles, in both voices, of the verbs *see* and *write*.

ANS.—To see, to be seen; to have seen, to have been seen. Seeing, being seen, seen; having seen, having been seen. For *write* take the forms *write* and *written* for *see* and *seen*.

6. Conjugate the verb *to be* in the indicative, future, perfect; *to hear* in the passive, potential, present; and *to go* in the indicative, past.

ANS.—The forms are *I shall have been*, *I may be heard*, and *I go*.

7. Define each of the subordinate elements of a sentence.

ANS.—See text-book.

8. Write a complex sentence containing adverbial elements of the first, second and third class.

ANS.—He came to school that he might learn rapidly. *Rapidly* is a 1st class adverbial element, *to school* 2d class, and *that he might learn* 3d class.

9. Analyze the following sentence: At daybreak on a hill they stood that overlooked the moor.

{ they	that
	overlooked moor the
{ stood	on hill a
	at daybreak

10. Parse the italicized words in the following sentences: *These apples* are very good; you *may eat such as* are ripe. He built *me* a house. If fortune *serve* me, I'll requite you.

Ans.—*These* is an adjective, belonging to *apples*. *Apples* is a noun, subject of *are*. *May eat* is a verb; it agrees with its subject *you*. *Such* is an adjective, modifying *apples* understood. *As* is a relative pronoun, subject of *are*. *Me* is a pronoun; it is the object of *for* understood. *Serve* is a verb, subjunctive mode, and agrees with *fortune* in person and number.

QUESTIONS FOR STATE EXAMINATION.

USED AT COLUMBUS, OHIO, IN JULY.

ALGEBRA.

1. There are two numbers such that the sum of the first and second is to the first as 3 is to 2; and the product of the first and second added to the square of the second = 3; find the numbers.
2. Given $\sqrt{x} + \sqrt{(x-24)} = 60 \div \sqrt{(x-24)}$, to find x .
3. There is a number consisting of 3 digits, which are in arithmetical progression; the quotient arising from dividing the number by the sum of its digits is 26, but if 198 be subtracted from the number, its digits will be reversed. What is the number?
4. The product of two numbers is a , and their quotient is b . What are the numbers?
5. Divide the number 100 into two such parts that the sum of their square roots may be 14.
6. The perimeter of a rectangle is 112 rd. and its area is 720 sq. rd. What are the length and breadth of the rectangle?
7. Solve $x^2 + x + 1 + (1 \div x) + (1 \div x^2) = 1$.

PHYSIOLOGY.

1. Name the divisions of the bones of the spinal column.
2. Account for muscular motion.
3. Describe the stomach as an organ of digestion.
4. Explain fully the causes and uses of the coagulation of the blood.
5. Why does the heart produce two distinct sounds in forcing the blood through the body?
6. In what two ways is the chest enlarged in inspiration?
7. Oxygen is said to be the "sweeper of the living body"—explain.
8. How should a school room be lighted? Give reasons for your answer.
9. Name five poisons with their proper antidotes.
10. Give reasons why a knowledge of physiology should be made essential in the qualifications of a teacher.

PHYSICS.

1. Discuss energy, its conservation and transformation.
2. How much energy is stored in a body which weighs 150 kilogrammes at a height of 30 metres?
3. Describe the series of experiments by which the laws of the pendulum may be derived.
4. A certain specimen of rock weighs in air 50 grammes, in water 35 grammes; find its specific gravity, and determine the weight of 500 cubic centimetres of it.
5. Define or illustrate specific heat, mechanical equivalent of heat, coefficient of expansion.
6. Fifty kilogrammes of mercury (specific heat 1.30) at 50 deg. C. will melt what weight of ice at 100 deg. C.?
7. The volume of a given quantity of gas at 50 deg. C., barometer 100 millimetres, is 2 litres; what will be its volume at 95 deg. C., barometer 300 millimetres?
8. How would you arrange the cells of a battery so that the strongest current might be obtained over a long telegraphic line? How to make the strongest short current electro magnet? Explain.
9. Give the laws of pitch and loudness of sound. Upon what does the quality of a musical sound depend?
10. State briefly your method of teaching physics.

GEOMETRY.

1. Prove that a radius perpendicular to a chord bisects the chord.
2. How many degrees in an angle inscribed in an arc of 135 deg.? How many deg. in the angle formed by two secants meeting without the circle and including arcs of 60 deg. and 110 deg.?
3. What part of a right angle is each interior angle of an equiangular decagon? Each exterior angle?
4. Prove that the three angles of a triangle are equal to two right angles.
5. The sides of a triangle are 60, 80 and 100 ft., the diameter of the inscribed circle is 40 ft.; find the area.
6. The radius of a circle is 10 ft.; find the apothegm of a regular inscribed hexagon.
7. To what is the area of a circle equal? Why?
8. To what is the convex surface of a pyramid equal? Why?
9. What is the volume of a pyramid equal to? Why?
10. What is the convex surface of a frustum of a pyramid equal to? Why?

LITERATURE.

1. Name the greatest of the Elizabethan writers, and give a brief account of your own reading of these writers.
2. Give the author of each of the following: Edward the Second, Faustus, The Alchemist, The Two Noble Kinsmen, Cymbeline, The Advancement of Learning, Utopia, Gebir, The Ring and the Book, Earthly Paradise.

3. Give a brief description of the Rape of the Lock, and point out the distinguishing literary traits of its author.

4. What are Wordsworth's highest merits as a poet? Name some of his choicest lyrics, and give illustrative quotations.

5. Describe the style of Bacon's Essays, Landor's Imaginary Conversations, or Emerson's Conduct of Life.

6. Compare the poetry of Byron with that of Shelley.

7. Name the finest poetic productions of each of the following authors: Robert Browning, Matthew Arnold, James Russell Lowell, William Cullen Bryant.

8. Who are some of the greatest philosophers that have written in English? Historians? Critics? Men of Science?

9. Make an estimate of the genius and writings of any author whose works you have critically studied.

Much importance will be attached to the ability and literary skill in answering this last question.

RHETORIC.

1. Define rhetoric.

2. What is invention? What is its value?

3. What are barbarisms? Name two.

4. Define tautology. Give an example.

5. Define simile and give an example.

6. What is an apostrophe? Give an example.

7. Explain the difference between wit and humor.

8. As a quality of style upon what does perspicuity depend?

9. Define style. Illustrate.

10. Name some extracts suitable for the student who wishes to cultivate a good style.

Editorial Notes.

Welcome to the hundreds of new accessions to the *Visitor* family since our last issue. Thanks to the kind friends who secured them. We are encouraged.

Our friend, D. B. Etzler, principal of the Gordon schools, is now clerk of our board of school examiners. Teachers will find him kind and obliging.

J. W. Pfeiffer, a noted teacher of Tuscarawas Co., raised the largest club this year. He is still adding names to his list at the same rate. Keep the ball rolling, friends, and you shall be rewarded for the interest you manifest.

We receive letters from all parts of the United States and Canada, speaking in terms of highest praise of the practical, instructive and valuable character of the *Visitor*. They say it is decidedly the best publication of its kind in this country. Hence all live and progressive teachers and students subscribe for it when they become acquainted with its merits. Sample copies sent free.

We have now published all of the state list of examination questions we could get, and answers would have been given had space permitted. We urge our friends who have the necessary qualifications, to attend the next examination at Columbus, during the Holiday vacation, and get at least a ten-year certificate. For this grade, you are examined only in the branches required at a county examination with the addition of school law. Do not take a bundle of credentials. A certificate from the county board or a few good recommendations will suffice. County boards ought to encourage their teachers, and give them proper recommendations to the state board.

ENGLISH GRAMMAR.

Answers to Queries.

1. Will you give us a specimen of Anglo-Saxon? S. A. S.

Ans.—The Lord's Prayer. Fæder ure, thu the eart on heofenum, si thin nama gehalgod; to becume thin rice; geweorðbe thin willa on eorðan swa swa on heofenum. Urne ge dæghwamlican hlaf syle us to-dæg, and forgyf us ure gyltas swa swa we forgyfadh urum gyltendum, and ne gelæde thu us on cost-nunge, ac alys us of yfe.

2. Why have we some words belonging to a class of objects from the Anglo-Saxon and others of the same class from the Anglo-Norman? Id.

Ans.—Because, after the battle of Hastings and during the Norman dynasty, words were adopted into the language according as the objects or the ideas expressed by them belonged more exclusively to the one race or the other. The Saxons retained the titles of *king* and *queen* and the Normans introduced *throne*, *crown* and *sceptre*; the Anglo-Saxon titles *earl*, *lord*, *lady* and *knight* remained, and *prince*, *duke*, *baron*, *peer*, etc., introduced from the Anglo-Norman. Likewise we have from the Anglo-Saxon, *house*, *room*, *kitchen*, *hearth*, *threshold*, *wall*, *roof*, *window*, *stool*, *bench*, *bed*, *pillow*, etc.; and from the Anglo-Norman, *palaces*, *castles*, *mansions*, *chambers*, *parlors*, *galleries*, *pantries*, *laundries*, *chimneys* (the Saxons had no chimneys), *table*, *chair*, *couch*, *carpet*, *curtain*, etc., all expressive of the manners and customs of the race.

3. Parse—The food is *salty enough*. He does not like *to be made fun of*. PREBLE.

Ans.—*Salty* is an adjective, used in the predicate with the verb *is*. *Enough* is an adverb, modifying *salty*. *To be made fun of* should be parsed as an agglutinated verb. We can not dispose of *fun of* very satisfactorily in any other way.

4. Diagram—Who's here so base that would be a bondman?

[who base so is here		(that)	[he would be-bondman a

5. Diagram—I speak as to wise men: judge ye what I say.

[I speak as to men wise	(and)	[ye judge thing		the
				I
				say which

6. What are impersonal verbs?

Ans.—Verbs which affirm a mere event without reference to the agency by which it is effected; as, *it rains*, *it strikes* twelve, *it came to pass*. Also, *meseems* or *methinks* (it seems to me, *think*, to seem, being a different word from *think*, to imagine), are classed among impersonal verb. In parsing it is best to consider *it* the subject of the verb, and *me* the object of *to* understood.

7. Put a noun in apposition with a noun in the possessive case.

Ans.—I called at *Brown's*, the well-known *stationer*.

NOTE.—This department will be changed at the end of this year, so as to embrace a wider field in language. We expect to include *literature* and *language*, and open it for contributions from well-qualified writers. This will make it very valuable. The answers to the grammar in state list, published last month, were read with interest. Such good things can be expected in the new dep't.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

NOTE.—We desire answers to queries Nos. 129, 182, 398, 494, 505, 535, 636, 817, 926, 929, 936 and 958. All the other queries, over a thousand in all, have been or soon will be answered. No publication devoted to miscellaneous queries and answers has succeeded better than the *Visitor* in giving such a large per cent of answers.

ADDENDA.—To answer of 968, p. 177. A little boy was passing the College one day, when one of the students was standing inside with a human arm in his hand. The student in a jest said to the boy "This is your mother's arm that used to beat you." This terrified the boy whose mother had died not long before, unknown to the student. The boy ran home and told the father, who took suitable assistance with him to examine the grave. They found the grave empty, and also others which they examined. The news spread, a mob was collected and the students driven from College. See *Youth's Companion*, 1873.

NOAH A. WARE.

To answer of 1005, p. 207. I notice the "Home" recently established at Leavenworth, Kansas, is omitted. Its post-office address is *National Military Home, Leavenworth Co., Kansas*.

W. C. BINKLEY.

1091. What is the origin of *chicken-hearted*—coward? L. M. O.

Ans.—From the fact that young fowls are very timid, running to the wing of the hen or seeking other covering, upon the slightest alarm. EDITOR.

1092. In what battle was Gen. Lyon killed? F. H. GOUDY.

Ans.—At Wilson's Creek, Mo., in attacking the Confederate forces of Price and McCulloch. He was struck by a minie-ball, and died Aug. 10, 1861, leaving his estate to the government. He was born at Ashford, Conn., July 14, 1810; graduated at West Point in 1841.

EDITOR.

613. Where and what are Jemen, Paumotu, Pico dos Orgaos, Roggeveld, Sunbing, and Tangkuban? ED. RYNearson.

Ans.—*Jemen*, or *Yemen*, is the southwestern division of Arabia on the Red Sea.

Paumotu, or *Low Archipelago*, is a large coral group in the Pacific Ocean, long. 140° W. and lat. 20° S.

Pico dos Orgaos (Peak of the Organ) is the highest peak of the Sierra dos Orgaos or Organ Mountains in Brazil near Rio Janeiro.

Roggeveld (Rye-field) is the western continuation of the Nieuveveld Mountains, and a large neighboring prairie district, in Cape Colony, Africa.

Sunbing, or *Kunbing*, is a small island of Malay Archipelago north of Timor, belonging to Portugal.

Tangkuban, sometimes written *Tacloban*, is one of the Philippine Islands.

These names of places are given in the vocabulary of No. 3 Eclectic Geography, and we are indebted to the publishers for this answer. EDITOR.

746. Give the emblems of European countries.

D.

PARTIAL ANSWER.—The *Eagle* is the emblem of Austria, Russia, Germany, France, Bohemia and Moravia; the *Lion* of Great Britain, Spain and Portugal. Who can give a more complete answer?

EDITOR.

949. What is meant by the term *Bloody Bridge*?

Ans.—The event in the New England states, when a great many people were killed by Indians. They were all piled on a bridge, in the center, the outer edges of which were covered with the blood of the slain. It became known as "The Bloody Bridge."

DARKE.

948. Has the earth ever passed through the tails of comets? *Id.*

Ans.—No comet, so far as known, has ever come in contact with the earth or mingled its substance with our atmosphere. The nearest approach ever observed was the comet of 1770 (Lexell's) which passed, on the same day as the earth, through a point but 168,000 miles distant from that occupied by the earth five hours later.—*Encyclopedia Americana*.
EDITOR.

986. Soon after the war a Northern writer, who gave his initials "S. M. S." wrote a *History of the Civil War in the U. S.* Who was (or is) S. M. S.?
JULIUS A. SHEETS, *Calvary, Va.*

Ans.—Samuel M. Schraucker (S. M. S.) was reared and educated at Gettysburgh, Pa. He graduated from Pennsylvania College located at that place. His father was for many years Professor of Theological Seminary at Gettysburgh. W. H. Venable, A. M., LL. D., the teacher, author, and poet of Tusculum, kindly tells us, "S. M. S. published a history of the Civil War in 1863-5, in 3 Vols., at Philadelphia; and a one volume history in 1865."
EDITOR.

998. Explain meaning of italicized words, used by Rose Cleveland and taken from the *Normal Monthly*: "In these days of ebb and quicksand, when agnosticism rears its stone-wall in front of faith, and writes upon it in black letters, *the end-all and the be-all of all knowing, the unknowable*, we have need to go where God is to confirm our faith in Him."
J. R. BALDWIN.

Ans.—We shall endeavor to interpret her meaning. She probably alludes to the doctrine of the late Herbert Spencer and his followers, who hold, in the language of Spencer, "that our own and all other existence is a mystery, absolutely and forever beyond our comprehension," and that the Absolute and "Unknowable" is a universal and "persistent force." The fundamental notion in question is, that the "mind," the apparent agent of knowledge, is held to be a *tabula rasa*, or like a piece of white paper, upon which objects by mechanical impact produce impressions, out of which knowledge is compounded, and all that is known is the relative or sensibly phenomenal, and not the absolute, or things-in-themselves. The result of such views is philosophical scepticism, as it renders the very conception of the Absolute unaccountable. The closing sentence gives her own conviction. Are we correct?
EDITOR.

1007. What is known as "The Maiden Town"? *Id.*

Ans.—"The Maiden Town" is a name properly given to Edinburgh, from a monkish fable or tradition that it was once the residence of the daughters of Pictish kings, who were sent to this stronghold for protection in times of war and trouble.

"Your hands are weak with age," he said,
"Your hearts are stout and true;
So bide ye in the *Maiden Town*
While others fight for you."

LEVI MINNICK.

Answered by Eva N. Miller, Noah A. Ware and Ed. Ryneerson.

1008. Define industrial and manual schools. What distinction between them? Name the seven elementary tools.

S. R. BAILEY, *Kansas City, Mo.*

Ans.—Industrial schools are devoted to one or more of the leading industries, while manual schools give attention to the training of the hand, as preparatory for the duties of the workshop generally. We never saw a list of the "seven elementary tools," but the square, hatchet, saw, chisel, auger, compasses, plane seem to be very important tools. Who can give any established list? EDITOR.

1009. "Mark that man, for he is in himself a host. Let me see him no longer." In what battle and by whom was this command given? Who is meant?

NOAH A. WARE, *W. Manchester, O.*

Ans.—In the battle of Stillwater, sometimes called the second battle of Saratoga, Oct. 7, 1777, Gen. Frazer's division had fallen on the American flank. They were repelled by Morgan's corps, which then vigorously charged the British right. At this point Arnold, who had been deprived of his command by Gates, mounted his brown horse and dashed into the hottest of the fight, and with a desperation akin to madness, he charged Frazer's brigade, now rallying under their intrepid commander. Perceiving that Frazer was the soul of the British army, and after a dozen riflemen had been selected, Arnold passed the command as given in the query. The riflemen flew to their places. A ball soon struck the general's saddle; another wounded his horse in the neck; but the gallant Frazer refused to retire, and in a few moments fell mortally wounded. Frazer's fall decided the battle. We are indebted to Mr. Ware for placing this incident.

EDITOR.

1010. Why is the Pacific calmer than the Atlantic? CHAS. BIGLER.

Ans.—On account of less land surface in the tropical regions along its boundaries and its greater extent, the Pacific having a coast-line less than half that of the Atlantic. As a natural result, the mean atmospheric pressure of the Atlantic varies more than that of the Pacific. The low average pressure for a region in the North Atlantic gives rise to terrific storms which sweep over Europe, and where the storms cross the Atlantic from America develop intensity.

EDITOR.

1011. Give an account of the Aroostook War. L. M. O.

Ans.—The Aroostook War attended the long agitated question concerning the northeast boundary between British America and the United States.

ED. RYNEARSON.

1012. Explain the method of telegraphing from running R. R. trains.

Id.

Ans.—We consider Phelps's system the best. He places an insulated wire in a case on the ties midway between the rails. Beneath the car, extending from one truck to the other, he arranges an induction coil, which comes within 7 in. of the track wire, making a circuit of a mile and a half long to the receiving relay in the car. The principle involved is this: When two wires are extended parallel, close together, and a current is sent through one, a momentary current is excited by induction in the other. When an electric signal is sent through the track wire, it produces a corresponding current in the wire attached to the car, and this current works the sonnder and the message is delivered, no matter how fast the train may run. Messages from the car are transmitted the same way. This principle of induction has been the bugbear of underground telegraphy.

EDITOR.

1013. How many telegraphic alphabets in use? Did Morse invent one?

WARREN LOY.

Ans.—The Morse Alphabet is in general use. Prof. Morse, by the assistance of his brother, who was a printer, made this alphabet.

EDITOR.

1014. What is the best theory as to the origin of the glacial period?

Ans.—The best theory with which we are acquainted, and which geologists have been disposed to accept, is that offered by Dr. Croll. He ascribes the phenomena to the variation in the eccentricity of the earth's orbit, and the cyclical change through which the earth is nearest to, or farthest from, the sun in winter. This cycle is 21,000 years. The important cause is the variation in eccentricity of the earth's orbit. He estimates that three eras of high ellipticity have occurred within 3,000,000 years, the latest of which began about

240,000 years ago and continued for 160,000 years. This epoch, in his opinion, was the last great glacial period, when vast bodies of ice in the north were melted and glaciers formed, giving rise to extensive floods, transporting the mud and sand far to the south, and forming our sand and gravel banks. The fragments of the great American glacier caused depressions and modifications in the surface, depositing here and there boulders, sand and gravel, and forming lakes where the water in which they floated was shallow.

EDITOR.

1015. Who were the "six boy kings" of England?

Id.

Ans.—The six boy kings of England were Edmund, Edred, Edwy, Edgar, Edward, and Ethelred.

Edmund, the Magnificent, ascended the throne about the year 940, at the age of eighteen. He conquered Northumberland from the Britons, and bestowed it on Malcolm, king of Scotland, on condition that he should do homage to him, and defend the northern frontier from the Danes. He was assassinated in his own castle by a noted robber named Leof, who had been banished from the kingdom, but had returned.

Edmund was succeeded by his brother, Edred, whose reign is memorable for the establishment of monasteries in England, and for the influence which Dustan, abbot of Glastonbury, possessed over this superstitious monarch. Dustan, who was really the king, concealed great ambition under the cloak of sanctity. The ignorance and credulity of the times can not be better illustrated than by the stories which he made the people believe. In his miserable cell, the devil, affronted, as he said, by his holy mortifications, annoyed him by frequent conflicts. At length, he came one day in the shape of a woman. St. Dustan seized him by the nose with a pair of red-hot pincers. Satan roared and bellowed, and after this never dared to show his face to the valiant monk.

Edred left the throne to Edwy, the Fair, a prince of seventeen, elegant in person and ardent in his affections. The beautiful Elgiva, his second cousin, had captivated his youthful heart, and he married her, contrary to the decree of the church, which forbade marriages between persons of this degree of affinity. Dustan denounced and insulted him; and he boldly banished the monk from the realm. But the spirit of fanaticism,—the prevailing spirit of the age,—was on the side of the church. Odo, archbishop of Canterbury, tore Elgiva from her husband, and caused her to be branded, or scarred, in the face with a red-hot iron, to destroy the beauty that had ensnared the king. The hapless wife escaped from the cruel hands of her persecutors, and was returning to her husband, when they retook, murdered her, and dethroned the wretched Edwy; who, forsaken by his subjects, and excommunicated by the relentless clergy, soon rested from his sorrows in death.

Edgar, a boy of thirteen, brother to Edwy, succeeded him; and Dustan, who had now returned, took the government in the name of the young prince. This monk set himself against the marriages of the secular clergy, and obliged great numbers of them to separate from their families. He was also active in endowing monasteries, and thus shutting up in idleness many men whose services the kingdom needed. Edgar, as he grew to manhood, saw the difficulty of his situation, and in reality proved the master spirit of his kingdom; but his character presents us greatness without virtue. Flattering the monks, he preserved their favor; and, unrestrained by moral principle, he violated, in the pursuit of pleasure, all laws, human and divine. He built and supported a powerful navy, which he divided into three squadrons, commanding each to make by turns the circuit of his dominions, thus keeping the seamen in practice and intimidating the Danes. His marriage with his second wife, Elfrida, was one of the worst events of his reign. Hearing of her beauty, he sent Ethelwold, his favorite, to see if her charms deserved the praise bestowed upon them. Ethelwold, enamored of her himself, falsely told his master that report had exaggerated her beauty—but that she was a rich heiress, and would be a desirable match for himself. Edgar promoted the union. Afterwards, suspecting treachery, he determined to visit the castle of Ethelwold. The distressed husband confessed to his wife the fault his passion had led him to com-

mit, and besought her to conceal her beauty as much as possible. But Elfrida was careful to attire herself in the most becoming manner. The monarch was charmed, slew the husband with his own hand, and married Elfrida. She who had thus connived at the destruction of her husband, carried dissension and disaster into the royal family.

Edward, son of Edgar by his first wife, was raised by Dunstan to the throne, in opposition to the wishes of Elfrida, who desired her own son, Ethelred, to receive the crown. He obtained the surname of "the martyr," for the wicked Elfrida soon caused him to be murdered, thus securing the crown for Ethelred.

Upon the accession of Ethelred to the throne, the Danes, with fresh hopes and recruited strength, again entered England, and the weak monarch gave them money to depart. This was both a lure and an acknowledgment of weakness; and, as if yet to add another inducement to the myriads of the northern hive, the weak and cruel son of Elfrida gave orders for a general massacre of all the Danes in his dominions; and the order was executed with the utmost inhumanity. Among the number was Gunhilda, sister of the king of Denmark—a Christian princess, married to a nobleman of England. The mother was made to witness the dying agonies of her children, who were put to death before her face; after which she herself was inhumanly slain. The fierce wrath of Sweyn, king of Denmark, was enkindled. He collected a formidable armament, landed in the west of England, and carried fire and sword through the land. The timid king fled to Robert, Duke of Normandy, whose sister Emma he had married for his second wife. Sweyn died before he had time to establish himself in his conquered dominions. Ethelred died shortly after he returned to England.

JOHN H. KNIESLY, *Gettysburg, Ohio.*

1016. Define *Americanist* and *Boodle*. Give origin of latter. *Id.*

ANS.—*Americanist* is a new word, not found in Webster, that has grown out of certain congresses held in European countries for the purpose of inciting to the study of American archæology. Hence it means a person interested in the antiquities of the American continent. *Boodle* means *money*, and is now used by the press in speaking of public men who secure positions by the use of money. We can not give the origin of the word. Who can?

EDITOR.

1017. What is smoke, and what becomes of it?

E. N. M.

ANS.—Smoke is the product of imperfect combustion, consisting of fine particles of carbon and gases. The gases are absorbed by the atmosphere and the carbon is precipitated.

EDITOR.

1018. Describe Victoria Falls, Africa, and give their height. *Id.*

ANS.—Victoria Falls are bounded on three sides by ridges 300 or 400 feet in height. They simply seem to be a crack made in a hard basaltic rock, from bank to bank of the Zambezi River. The water leaps down 100 feet, and becomes suddenly compressed into a space of 15 or 20 yds. and then prolonged from the left bank away through 30 or 40 miles of hills.

DANIEL EIKENBERRY, *Painter Creek, O.*

1019. By what common name are the big trees of California known?

Id.

ANS.—The big trees of California are known as the Redwood, *Sequoia Sempervirens*. They are only found in any considerable quantity on the western slope of the Coast Range and the Sierra Nevada.

N. W. COOL.

Also answered by Ed. Rynearson and Noah A. Ware.

1020. Who wrote the following and where found?

Id.

Breathes there the man with soul so dead,
Who never to himself hath said,
"This is my own, my native land!"

ANS.—Sir Walter Scott wrote it. You will find these lines in *Lay of the Last Minstrel*, 6th Canto.

EDITOR.

1021. Give a brief sketch of Phillis Wheatley, Hannah Duston and Mercy Warren.

Laura.

Ans.—Phillis Wheatley was a negro poetess, born in Africa, 1750, and bro't to Boston as a slave in 1761. She wrote a book of poems which was published in London, 1773, while she was in that city with the son of her owner. She received her education from her mistress, and was quite proficient in Latin. A poem sent to Gen. Washington gave her enduring fame.

Editor.

King William's war continued to afflict the colonies till 1697. Its later operation were carried on mainly by the Indian allies on either side. One incident connected with this savage warfare has made the name of Hannah Duston memorable. This heroic woman was confined to a sick-bed in her home near Haverhill, in northeastern Massachusetts, when the town was attacked by Indians. Her husband, at work in a neighboring field, kept off the savages while seven of his children made their escape, but could not prevent the murder of his new-born babe or the capture of Mrs. Duston and her nurse. The two latter were driven along, till they reached an island in the Merrimac a few miles above Concord. Here Mrs. Duston, learning that she was to be taken many miles further, resolved to regain her freedom. A boy was her fellow-captive. Waking him and her nurse one night when the Indians were asleep, she assigned a part to each and bade them strike their captors. Despair nerved the feeble arms, and ten stalwart savages were slain with their own tomahawks. More merciful than they had been to her, Mrs. Duston spared an Indian child, one woman escaping. Seizing on the canoe that had brought them thither, the two women and boy then descended the Merrimac, and were soon safe among friends who had mourned them as lost. A granite monument reared on Contoocook Island, through the efforts of Robert B. Caverly, the poet and historian, now commemorates the spot and deed. *Quackenbos' American History.*

Eva N. Miller.

Mercy Warren, daughter of Col. Jas. Otis, and wife of Jas. Warren, a Plymouth merchant, was born in 1728 and died in 1814. She was one of the first American women poets, and as a historian of Revolutionary times, she ranks among the best.

Editor.

1022. What is known of the elect lady to whom John addresses his Second Epistle?

Id.

Ans.—Electa was a wealthy and accomplished lady of Judea, who was reared a heathen, the idols of Rome being the only gods she knew. But she and her interesting family heard from inspired lips the story of Calvary, whereupon they professed before the world their faith in the despised Nazarene, though to do so, was to expose themselves to persecution and to death. Fourteen years passed, however, before the trying scene came upon them. During this time she gave her income and the comforts of her elegant mansion to weary and persecuted pilgrims. Through all the land among the poor people, her name was famous as the beneficent and affectionate Electa. The time of her martyrdom drew nigh. A great persecution came, and a body of soldiers made a cross on the ground, and said that if she would put her foot upon it, she should be spared; but she refused, and they were cast into a dungeon. The Roman judge came and offered her another opportunity to recant. She again refused, and the drama closed. The whole family were scourged to the verge of death, then drawn by oxen to the nearest hill and crucified. It is said she was the last to be nailed to the cross.

Editor.

1023. When and how did the political platforms as now in vogue originate?

Preble.

Ans.—The first national political platform was adopted by the Democratic convention at Baltimore, May 5, 1840. Previous to this addresses to the people were issued by the conventions. After 1831, when the national convention came into vogue, the address was prepared by a committee. The Democrats at the convention of above date, put up Van Buren upon nine resolutions,

which formed the basis of that party's platform up to 1860. In 1840 the Whigs nominated Henry Clay and passed one resolution. In 1848 they nominated Taylor upon no platform whatever, the chairman of the convention ruling all resolutions out of order. The minor parties in 1844, 1848 and 1852 adopted extensive and comprehensive platforms, and the Republicans likewise in 1856. At present we find a disposition to insert special-interest planks, in which there is often ambiguity if not downright hypocrisy, giving the platforms an air of insincerity which is to be deplored.

EDITOR.

1024. A letter was recently deposited in the Cin. P. O., addressed to Gate City, No Man's Land. Where should the "Nixie" clerk send it?

ANS.—He should send it to "Gate City, Indian Territory." The narrow strip of land west of the 100th meridian which was ceded by Texas to the U. S., and which is classed geographically with the Indian Territory for convenience, is designated officially as "Neutral Strip," "Neutral Lands," and occasionally, "No Man's Land." At present it contains only two post-offices, Beaver and Gate City. See P. O. Guide for 1886.

W. C. BINKLEY.

"No Man's Land" is a strip of country, including the pan handle of Indian Territory. Mail should be addressed "Gate City, Indian Ter." TECUMSEH.

1025. Mention some notable "Dark Days," and give the cause of these unusual obscurations of the sun?

Id.

ANS.—"Many stormy and foggy days have been recorded in modern times, when it was necessary to light candles at midday and impossible to travel the roads, and which are fully explained by the known facts of meteorology. Such were the 9th of Aug., 1732, when New England was enveloped in darkness; the dark day in England in 1678; the 1st of Jan., 1807, when the sun was hidden by clouds in Essex Co., England; the 1st of Oct., 1816, another dark day in England; the 21st of the same month in New England, when candles had to be lighted at midday; the 16th of Oct., 1783, when the blackness of night settled over Canada, followed by thunder showers and a hurricane; there were also numerous others. One of the most noted instances of the obscuration of the sun from meteorological causes was the famous dark day in New England, May 19, 1780. The gloom was most intense in New Hampshire and Maine. It was necessary to light the candles in the houses in New England. The Connecticut legislature adjourned on account of the darkness."—*American Cyclopaedia*.

Numerous other dark days are also mentioned in the above work, which were caused by the dry fog, dry mist, red rain, volcanic disturbances and earthquakes.

W. C. BINKLEY.

A notable dark day occurred in New England, May 19, 1780, during the session of the Connecticut Legislature, which caused an adjournment. Remarkable dark days occurred B. C. 295; A. D. 252, 746 and 775, and during the crucifixion darkness was "over all the earth" for three hours. In England dark days prevailed in Jan., 1807, and on Oct. 21, 1816; in Detroit, Mich., Oct. 19, 1762; in Canada Oct. 16, 1863; in London, May 10, 1812, Dec. 27-29, 1813, and Nov. 27, 1816. Various hypotheses have been given to account for these phenomena, such as the smoke of burning forests, volcanic smoke and ashes, vapors generated by internal heat, smoke from meteors, cosmical dust drifting from outer space into our atmosphere; terrestrial dust from deserts, and double strata of clouds, re-inforced by smoke from furnaces and factories.—*People's Cyclopaedia*.

A. L. MENDENHALL.

1026. Who have been impeached by the House? Why? M. C.

ANS.—There have been seven cases of impeachment of federal officers by the House of Representatives, as follows:

WILLIAM BLOUNT, a senator from Tenn., in 1797, for an alleged participation in a conspiracy to transfer New Orleans from Spain to Great Britain by the

and of military and naval forces, and to enlist some of the Indian tribes in the same. His counsel pleaded that the office of senator was not such a civil office as was intended by the Constitution, and that having been expelled by the Senate, Mr. Blount was no longer an officer, and not subject to the process of impeachment. The Senate sustained the plea.

JOHN PICKERING, district judge for the federal district of New Hampshire, was impeached in 1803 for drunkenness and profanity on the bench, and other irregularities. He was convicted and removed from office, but it is believed that he was insane at the time of his trial.

SAMUEL CHASE, associate justice of the Supreme Court, in 1804 was charged with arbitrary and overbearing conduct, on the trial of certain political cases, manifesting partiality, injustice and oppression. The trial took on a party character, and the Federal senators, who constituted more than a third, voted for acquittal, and it became impossible to convict him.

JAMES H. PECK, district judge of Missouri, was impeached in 1830, for an abuse of his judicial power in punishing L. E. Lawless, a member of the bar, as for contempt of court, for a severe criticism in a newspaper of one of his judicial opinions. He was not convicted, a small majority of the Senate voting in his favor.

WEST H. HUMPHREYS, a district judge of Tennessee, for aiding the Rebellion in accepting a commission as judge of a confederate court, etc. He made no defence and was convicted.

ANDREW JOHNSON was impeached in 1868, on eleven charges, three of which were voted upon. Two of these were based upon alleged violations of the tenure-of-office law, in an attempted removal of Edwin M. Stanton from the department of war and the substitution of Lorenzo Thomas in his place. The other was founded on language used by him in a public speech, affirming that the 39th Congress was not a constitutional Congress, because part of the states were not represented. Seven republicans refused to vote for conviction, and an acquittal followed on a vote of 35 to 19.

WILLIAM W. BELKNAP, was impeached by the House in 1876, for a corrupt use of his power of appointment as Secretary of War. A few hours before the impeachment, he resigned and the President accepted his resignation. The Senate, after debating the question of jurisdiction, proceeded with the trial which resulted in his acquittal. A. L. MENDENHALL, *West Manchester, O.*

1027. Explain the meaning of the phrase in italics—Let him remember that ambition, like the *Amrita cup of Indian fable*, gives to the virtuous an immortality of glory and happiness.—*Grimke. Id.*

ANS.—*Amrita* is from the Sanskrit, signifying *immortal*, and in Hindu Mythology refers to the elixir of immortality which the gods made by churning the milk-sea. They removed the mountain *Mandar*, with its forests and inhabitants, down to the sea, placed it upon the back of the Tortoise, and *Indra* whirled it round like a churn, stirring up the waters of the ocean for the discovery of the *Amrita*. From the violent agitation that followed, forest trees were precipitated, and the birds thereon; a raging fire ensued which involved the whole mountain with smoke and flame, devouring the lion, elephant and every specific thing. The flames were quenched by a shower of rain upon the immortal *Indra*. Then a heterogeneous stream of the concocted juices of vegetable substances ran into the briny deep. This converted the waters of the ocean into milk, and from that milk a kind of butter was produced. While the gods stirred this substance, there arose from the troubled deep—first, the moon, shining with ten thousand beams of mellow light; then *Sree*, the goddess of fortune, whose seat is the white lily of the waters; and so on until the inferior gods had all emerged from the prolific mass. Finally, *Dhanwantaree*, in human form, came forth with a white vessel in his hand, filled with the immortal juice *Amrita*. All the gods clamorously exclaimed, "This of right is mine."

EDITOR.

QUERIES.

1067. What is known as the *Tower of Forty*? N. C.
1068. What were the "Thirteen Fires"? B. S. D.
1069. Who invented the miner's Safety Lamp? KATY DID.
1070. What two governments are bound together by "steel ties"?
1071. To what depth does light penetrate in clear water? What causes the changes in the color of the sea? S. A.
1072. Give termini of all the Atlantic Cables. Id.
1073. Why are *ae* combined in such words as *pæan*, and how would you designate such combinations in oral spelling? AMPHIC.
1074. What enables the chameleon to change its color? A. L.
1075. What is the connecting link between mind and matter? Explain fully. Id.
1076. Cats kill field mice, field mice destroy the nests of bumble-bees, and the bumble-bees assist in fertilizing clover. Now, what relation does the cat sustain to the farmer in this respect? W.W.W.
1077. What caused the panic on East-River suspension bridge, six days after it was opened for passage, in which twelve persons were killed and many wounded? Id.
1078. Give a list of twelve novels which you think are the best and noblest available to English readers. READER.
1079. Give a brief sketch of the Rev. Wm. R. Alger. Id.
1080. When and how was the roller milling process introduced into this country? MILLER.
1081. Who were—"The Orphic sage," "The American Rousseau," "The Scotch Archimedes," "The English Rabelais," and "The prose Homer of human nature"? L. B.
1082. What is the difference between *problem* and *example* as used in Arithmetic? J. S. H.
1083. What is the difference between a Revolution and a Rebellion, and what are the four points upon which a Revolution is based? Id.
1084. Who was the author of the Missouri Compromise? Id.
1085. Name Jeff Davis's Cabinet. Id.
- Ans.—See full answer p. 220, Vol 4.
1086. Will the editor discuss the disputed question as to the date of Ohio's admission into the Union? Id.
1087. Describe the battle of Hastings and assign a cause for Harold's failure. P. E. H.
1088. Explain fully the Earth's refrigeration. A. L. M.
1089. Why is the sky blue? S. S.
1090. To what diseases is the *Germ Theory* applied? Id.
- Answers on or before Nov. 1. Write on one of paper. Send good queries.



EDITED BY

JOHN S. ROYER.

VOL. VII.

NOVEMBER, 1886.

No. 11.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

923. If $\frac{1}{3}$ of 6 were 3, what would $\frac{1}{2}$ of 6 be? If 3 were $\frac{1}{3}$ of 6, what would $\frac{1}{2}$ of 6 be?

J. K. ELLWOOD.

By A. F. PARSONS, *Arroyo Grande, Cal.*

By the conditions $\frac{1}{3}$ of 6: $\frac{1}{2}$ of 6:: 3: ($x_1 = 4\frac{1}{2}$), or from the 2d statement, 3: ($x_2 = 4\frac{1}{2}$):: $\frac{1}{3}$ of 6: $\frac{1}{2}$ of 6.

By W. J. HUSSEY, *Ohio, Ill.*

If $\frac{1}{3}$ of 6 were 3, 6 would be 9, and $\frac{1}{2}$ of 6 would be $\frac{1}{2}$ of 9 = $4\frac{1}{2}$. If 3 were $\frac{1}{3}$ of 6, 1 would be $\frac{1}{3}$ of 6, and $4\frac{1}{2}$ would be $\frac{4\frac{1}{2}}{\frac{1}{3}}$ of 6 = $\frac{1}{2}$ of 6.

By PROF. COOPER D. SCHMITT, *Charlottesville, Va.*

The two ways in which the problem is stated will make no difference in the solution. We have the general way of solving such questions thus: The actual value of the one : its assumed value : : the actual value of the second: the second assumed value. Then, 2: 3 : : 3: $4\frac{1}{2}$ and $4\frac{1}{2}$ will be the supposed value of $\frac{1}{2}$ of 6.

By A. L. FOOTE, *Merrick, N. Y.*

The first query is equivalent to asking, If 2 be 3 what will 3 be? which gives 2: 3 : : 3: $4\frac{1}{2}$, *Ans.*

The second is equivalent to asking, If 3 be 2 what will 3 be? which gives 3: 2 : : 3: 2, *Ans.*

It may also be taken thus from the first: If $\frac{1}{3}$ of 6 is 3, then is 3 $\frac{1}{3}$ of 6, and the questions become identical; or, If 3 is $\frac{1}{3}$ of 6, what is 3?

The above is of such an ambiguous nature that whichever way we take it, it would be difficult to convince one philosophically, that the other was not correct.

NOTE.—We think $4\frac{1}{2}$ should be the true answer. See Vol. 6, p. 201 and Vol. 7, p. 10.

924. If I start from Detroit, Lat. $42^{\circ}20'$ N., Long. 83° W., in a southeasterly direction, and pursue that course on the arc of a great circle, where shall I strike the Equator?

By A. F. PARSONS, *Arroyo Grande, Cal.*

We have given in the spherical right triangle one side (the latitude) and the adjacent angle, 45° , to find the other side; or A and b to find a . $\text{Cota} = \cot A \div \sin b$, whence $a = 33^{\circ}57'30''$, and the required point is $83^{\circ} - a = 49^{\circ}2'30''$ West, a point of the Equator near the mouth of the Amazon.

By WM. WILEY, *86 Jefferson Ave., Detroit, Mich.*

Let Detroit be at D , and let the meridian DE cross the equator at E , and suppose I strike the equator at S . The spherical triangle DES is right-angled at E , and $DE = 42^{\circ}20'$; $\angle EDS = 45^{\circ}$, and we have by Napier's rules, $R \sin 42^{\circ}20' = \cot 45^{\circ} \times \tan ES = 33^{\circ}57'29''$. This is the difference of longitude between D and S , and the longitude of S is $83^{\circ} - 33^{\circ}57'29'' = 49^{\circ}2'31''$. This is among the islands at the mouth of the Amazon River, and about 30 miles north of the island of Johannes or Marajo.

925. I have four grades of wheat worth 75, 80, 90, and 95 cents per bushel, respectively. How must I mix the grades so that I may sell 900 bushels of the mixtures at \$1.02, on 3 months time, when money is worth 8%, and still make a present gain of 20%?

EDITOR.

By B. F. FINKEL, *North Lewisburg, Ohio.*

Present worth of \$1.02, due in 3 months at 8%, is \$1. Average cost per bushel is $\$1 \div 1.20 = \$.83\frac{1}{3}$. By Alligation

$83\frac{1}{3}$	75	$8\frac{1}{3}$	5	7	7	} 60 =	420 bu. at 75c.
	80	$3\frac{1}{3}$	2	2	2		120 " " 80c.
	90	$6\frac{2}{3}$	4	1	1		60 " " 90c.
	95	$11\frac{2}{3}$	7	5	5		300 " " 95c.

Balancing is done thus: One bu. bought at 75ϕ and sold in a mixture worth $83\frac{1}{3}\phi$, gives a gain of $8\frac{1}{3}\phi$; and a bu. at 95ϕ sold for $83\frac{1}{3}\phi$, gives a loss of $11\frac{2}{3}\phi$; $8\frac{1}{3}$ and $11\frac{2}{3}$ are as 5 to 7. The L. C. M. of 5 and 7 is 35. To gain 35ϕ on the 75ϕ wheat I must sell $35 \div 5 = 7$ bu., and to lose 35ϕ on the 95ϕ wheat, I must sell $35 \div 7 = 5$ bu., and so on. Balancing, the mixture will contain $7+2+1+5=15$ bu.; but we are to have 900 bu.; hence we multiply each by $900 \div 15 = 60$.

By J. W. KECKLER, *Weaver's, Ohio.*

The average price per bushel is $(\$1.02 \div 1.02) \div 1.20 = \$.83\frac{1}{3}$, and we have

$83\frac{1}{3}$	75	$11\frac{2}{3}$	$6\frac{2}{3}$	20	4	200 bu.
	80		$3\frac{1}{3}$	35	7	350 "
	90		$8\frac{1}{3}$	25	5	250 "
	95		$3\frac{1}{3}$	10	2	100 "

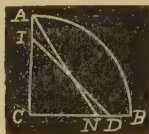
By J. W. PFEIFFER, *Bolivar, Ohio.*

The present worth of \$1.02 for 3 mo. at 8% = \$1.00, and $\$1.00 \div 120 \times 100 = 83\frac{1}{3}\phi$, the average price per bu.. If we sell a bushel worth 75 ϕ for 83 $\frac{1}{3}\phi$, we gain 8 $\frac{1}{3}\phi$. If we sell a bushel worth 90 ϕ for 83 $\frac{1}{3}\phi$, we lose 6 $\frac{2}{3}\phi$. Therefore, that we may neither gain nor lose on this, we must sell 4 bu. of the 75 ϕ kind to 5 bu. of the 90 ϕ kind. Similarly, we must sell 7 bu. of the 80 ϕ kind to 2 bu. of the 95 ϕ kind. Now one 9 and ninety-nine 9's = 900; hence, we must take 4 bu. of the 75 ϕ kind, 693 bu. of the 80 ϕ , 5 bu. of the 90 ϕ , and 196 of the 95. Total No. of answers to this problem are 99.

926. Divide a given quadrant into two equal parts by a line at an angle φ with one of the bounding radii. A. F. PARSONS.

By WM. WILEY, *Detroit, Mich.*

Let CDI be the given angle, φ , and let $CA = 1$, $CD = x$ and $t = \tan \varphi$. Then $CI = tx$, and $CI \times CD = \text{quadrant} = tx^2 = \frac{1}{4}\pi$. Hence $x^2 = \pi \div 4t$ and $x = \sqrt{\pi \div 4t} = \frac{1}{2}\sqrt{\pi \div t}$. If $ACN = \frac{1}{2}$ quadrant, or $\frac{1}{8}\pi$, then $AC \times CN = \frac{1}{4}\pi$; that is, $CN = \frac{1}{4}\pi$ and $t = 4 \div \pi = \text{tangent } 51^\circ 47' 24''$. Therefore, if $\varphi > 51^\circ 47' 24''$, part of the triangle will lie outside quadrant and the problem becomes very complex.



By MARTIN RICE, *Lone Jack, Mo.*

Let $AC = 100$, and the area of quadrant is $100^2 \times 3.1416 \div 4 = 7854$. If AN be the dividing line, the triangle $ACN = 7854 \div 2 = 3927$, and double the area, divided by the perpendicular AC , gives $CN = 78.54$, $AN = \sqrt{(100^2 + 78.54^2)} = 127.155$. By trigonometry, we have, $AC : R :: CN : \text{tangent of the angle } CAN = \tan 38^\circ 12'$.

927. A circular excavation was made for a water works, 74 feet in diameter and 20 feet deep, when it was found necessary for the center of the excavation to be 20 ft. further to one side; how many more cu. yd. of dirt would have to be removed? J. R. BALDWIN.

By A. F. PARSONS, *Arroyo Grande, Cal.*

Let A be center of first excavation, B the point to which the center was changed, D the intersection of the circles. From D draw DC perpendicular to AB , and BE parallel to AD . The area required equals

twice $(AB \times DC + \text{segment } DE)$.

We have $DC = \sqrt{(37^2 - 10^2)} = 35.62 +$; and $\angle ADB = 31^\circ 21' 38''$. Area of sector $BDE = 374.6953$; area $\triangle BDE$



$= 356.2302$. $\therefore$ area segment $DE = 18.4274$ and hence area of lune $DEHP = 1461.7756 = a$. Required solidity $= 20a \div 27 = 1082.8$ cu. yds. [Last line, preceding page, sector BDE should be 374.6576 .]

By W. J. HUSSEY, *Ohio, Ill.*

Let $AD = R = 37$, and $DAB = \frac{1}{2}DAP = \varphi = 74^\circ 19' 11''$, since $\cos \varphi = AC \div AD$. To find the volume required multiply the area of lune $DIPH$ by 20 ft. $DIPH = DFPH - DFPI$

$$= DFPH - 2(DAPI - DAP) = \pi R^2 - 2\varphi R^2 + 20R \sin \varphi$$

$$= R^2(\pi - 2\varphi) + 740 \sin \varphi = 749.322 + 712.461 = 1461.783 \text{ sq. ft.}$$

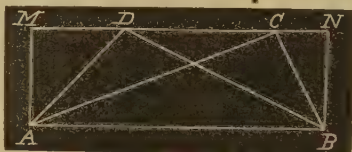
$$1461.783 \times 20 \div 27 = 1082.8 \text{ cu. yd.}$$

928. The sum of the squares of the diagonals of any trapezoid is equal to the sum of the squares of the unparallel sides plus twice the rectangle of the parallel sides.

J. W. PFEIFFER.

By COOPER D. SCHMITT, *Charlottesville, Va.*

Let $ABCD$ be the trapezoid, AC and BD the diagonals. Then we have $AC^2 = AD^2 + DC^2 + 2CD \cdot DM$; also, $BD^2 = BC^2 + DC^2 + 2CD \cdot CN$. Adding these two equations,



$$AC^2 + BD^2 = AD^2 + BC^2 + 2CD(DM + CN + DC)$$

$$= AD^2 + BC^2 + 2CD \cdot AB, \text{ since } DM + CN + DC = AB.$$

929. Three men carry a triangular plank weighing 300 lbs., 18 ft. long and 4 ft. wide at the base. How far from the larger end must a handspike be put parallel with the base, so that two men at the handspike may carry $\frac{2}{3}$ of the entire weight, the third man being at the apex?

B. F. FINKEL.

By J. W. PFEIFFER, *Bolivar, Ohio.*

Let ABC represent the board, and CF , AD , BE , the medians; also, F , E , D , the middle points of the sides. The point I is the intersection of the medians, and consequently the center of gravity.

$$AI = \frac{2}{3}AD; \quad BI = \frac{2}{3}BE; \quad CI = \frac{2}{3}CF;$$

Hence, the handspike must be placed at the end.



By A. L. FOOTE, *Merrick, N. Y.*

The plank being considered of uniform thickness from end to end, then will the center of gravity be $\frac{2}{3}$ of 18 ft. or 12 ft. from the small end and consequently 6 ft. from the large end; and since it is the same as if all the weight of the plank were accumulated in the center of gravity, it follows that the two men in order to carry $\frac{2}{3}$ of the

weight must place the handspike so as to correspond with the base of the plank that is the two men are 6 feet from the weight and the one at apex 12 ft. from the weight.

By WILLIAM HOOVER, *Athens, Ohio.*

From the well-known mechanical properties of the material triangle we find that, supposing the plane of the triangle to be horizontal, there must be a man at each vertex. The data are unnecessary.

930. A pole 100 feet high stands in water 10 feet deep. The pole breaking, the top, without falling off the stump, falls into the water leaving 25 feet between it and the stump at the surface of the water. What is the height of the stump?
A. M. SCRIPTURE.

By MARCELLUS M. THOMPSON, *Clarksburg, W. Va.*

Let $x = CH$, the height of stump above water, $HA = EI = 10$, $HE = AI = 25$, $CF = 90 - x$, and let $z = IF$.

From the right-angled triangle CAF ,
 $(x+10)^2 + (z+25)^2 = (90-x)^2$,
 which is $z^2 + 50z + 200x = 7375 \dots (1)$.

Also, from the similar triangles CHE and EIF , $x : 25 :: 10 : z$, from which
 $z = 250 \div x$. Substituting this value in (1), reducing, etc.,

$$x^3 - 36.875x^2 + 62.5x + 312.5 = 0,$$

whence by Horner's method, $x = 34.82883$ or 4.19285 , and the tree may break at either of two places, leaving stumps 44.82883 feet or 14.19285 feet, respectively.

By A. F. PARSONS, *Arroyo Grande, Cal.*

Let $x =$ length of stump above the water. Put $b = 10$, $a = 25$, and $c = 100$. Then $\sqrt{x^2 + a^2} =$ length of broken part above the water, and $(b \div x)\sqrt{x^2 + a^2} =$ length of same below the surface of the water, considering the bottom of the pond horizontal. Then

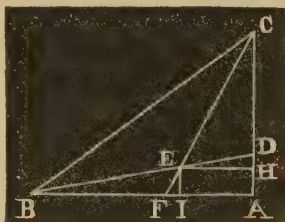
$$b + x + \sqrt{x^2 + a^2} + (b \div x)\sqrt{x^2 + a^2} = c \dots (1),$$

and which reduces to $2cx^3 + x^2(a^2 + 2bc - c^2) + 2a^2bx + a^2b^2 = 0 \dots (2)$. This equation has two positive roots, $x_1 = 34.8247$ and $x_2 = 4.1928$. Hence the height of the stump may be 44.8247 ft., or 4.1928 ft.

931. The diagonal of a square field is 20.71 chains longer than one of its sides. Find area, arithmetically, algebraically, geometrically. C. F. YOUNG.

By C. B. FREED, *Stauffer, Pa.*

The diagonal of a field 1 chain square is easily found to be 1.4141



chains. The diagonal is therefore .4142 chains more than the side. Then 20.71 chains is the excess of the diagonal of the field whose side is as many chains as .4142 is contained in 20.71, which is 50 chains; the required area is $50^2 \div 10 = 250$ acres.

By R. A. LEISY, Burton City, Ohio.

Let x = side of field in chains; then we have for the diagonal $x\sqrt{2}$ and $x\sqrt{2} - x = 20.71$, whence $x = 50$, and $x^2 = 2500$ square chains.

By B. F. FINKEL, North Lewisburg, Ohio.

Construct the square $AEKF$, making the side EK equal to 20.71, the given difference. Draw the diagonal AK and produce it to D , making KD equal to EK . Then AD is the side of the required square.



Draw CK . In the right-angled triangles ECK and KDC , we have, by the conditions, $EC = CD$ and the line CK in common to both. The triangles are therefore equal, and $DK = EK$. $AK = \sqrt{(AE^2 + EK^2)}$, and $AD = AK + DK$. Substituting for AK and DK , we have $AD = AE + AE\sqrt{2} = 50$ chains, nearly. Therefore $50^2 \div 10 = 250$ A. is the area nearly.

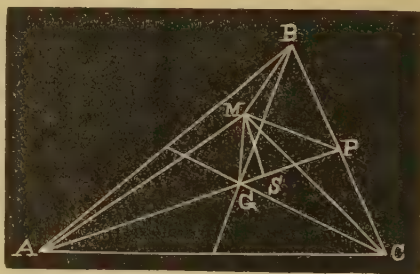
932. If G be the point of intersection of the medians of a triangle ABC , and M any other point whatever in the plane of the triangle, then we shall have $MA^2 + MB^2 + MC^2 = AG^2 + BG^2 + CG^2 + 3MG^2$.

COOPER D. SCHMITT.

By J. W. PFEIFFER, Bolivar, Ohio.

Let ABC be the triangle, G the point of intersection of the medians, M any point in the triangle, and P the middle of the side BC . Join M and P , and draw MS perpendicular to AP . In the triangle AGM , we have

$$AM^2 = AG^2 + MG^2 + 2AG \cdot GS.$$



....(1). In the triangle BMC , we have $MB^2 + MC^2 = 2PC^2 + 2MP^2$

....(2). In the triangle BGC , we have $BG^2 + GC^2 = 2PC^2 + 2PG^2$

....(3). In the triangle MPG , we get $PM^2 = MG^2 + GP^2 - 2GP \times GS$

....(4). Adding (1) and (2) and substituting the values of PC^2 and MP^2 , in (3) and (4), in the resulting equation, we have

$$MA^2 + MB^2 + MC^2 = AG^2 + BG^2 + CG^2 + 3MG^2 + 2AG \times GS. \text{ But } 4GP = 2AG; \text{ hence, } MA^2 + MB^2 + MC^2 = AG^2 + BG^2 + CG^2 + 3MG^2.$$

933. Considering that the English alphabet has 21 consonants and 5 vowels, how many words can be formed having three consonants and one vowel in each?

D. W. K. MARTIN.

By WM. WILEY, *Detroit, Mich.*

I shall assume that no consonant is to be repeated in the same word. The whole number of combinations of 3 each in 21 is $19 \cdot 20 \cdot 21 \div 1 \cdot 2 \cdot 3 = 1330$. Any one of these 1330, as *bcd*, makes, in combination with *a*, 24 permutations, and with the 5 vowels 120, making 159600, and I deal only in permutations, not in words, considering that the problem is in the mathematical and not in the grammatical department. For instance, the combination *abcd* furnishes 24 permutations, but not one word of 4 letters, while *star* furnishes 4 acknowledged words. Webster's Dictionary contains only about 100,000 words.

934. A quantity of air at a temperature of 15.6° C., has a volume of 4 cu. ft. under a pressure of 12 lbs. to the square inch. What will be its volume at a temperature of 48.7° C., under 14 lbs., to the square inch?

J. B. SANDERS.

By WILLIAM HOOVER, *Athens, Ohio.*

If V be the volume of a gas at pressure p and temperature t , and V' be its volume at pressure p' and temperature t' , a being the constant .00367, we have, (see Balfour Stewart's *Heat*, 4th ed., Clarendon Press Series, p. 131),

$$V' = V \frac{1+at'}{1+at} \cdot \frac{p}{p'}$$

Here $t = 15.6$, $V = 4$, $p = 12$, $t' = 48.7$, $p' = 14$; $\therefore V' = 4.009$ —.

By A. L. FOOTE, *Merrick, N. Y.*

Changing the Centigrade to Fahrenheit, we have $15.6^{\circ} \times 1.8 + 32^{\circ} = 60.08^{\circ}$ F. and $48.7 \times 1.8 + 32^{\circ} = 119.66^{\circ}$ F. Regnault gives the increase of volume for each degree of temperature as .00204th of volume at 32° F. Knowing the volume at 60.08° F. under a pressure of 12 lbs. to the square inch, we find the volume at 119.66° F. under the same pressure thus:

$$v' = 4 \left(\frac{1 + .00204(119.66^{\circ} - 32^{\circ})}{1 + .00204(60.08^{\circ} - 32^{\circ})} \right) = 4.45983 + \text{cu. ft.}$$

Since the volume is inversely as the pressure, we have

$$14 \text{ lbs.} : 12 \text{ lbs.} :: 4.45983 \text{ cu. ft.} : 3.8227 \text{ cu. ft.,}$$

the volume required.

NOTE—The foregoing solutions are similar in principle but different in result, because the constants .00367 for Centigrade and .00204 for Fahrenheit, do not agree, authors differing. If, in the formula given by Prof. Hoover, we take $a = \frac{1}{273}$, the result will be the same as Mr. Foote gives.

List of Contributors to this Number.

- GEO. A. STINE, *Lindsey, Ohio*, 923.
 MARTIN RICE, *Lone Jack, Mo.*, 926.
 A. M. SCRIPTURE, *Clinton, N. Y.*, 930.
 C. B. FREED, *Stauffer, Pa.*, 931.
 MARCELLUS M. THOMPSON, *Clarksburgh, W. Va.*, 930.
 PROF. WILLIAM HOOVER, *Athens, Ohio*, 929, 934.
 D. S. POND, *Rochester, Ohio*, 927, 929, 931.
 GEO. C. RUSSELL, *Petaluma, Cal.*, 928, 932, 933.
 WILLIAM WILEY, *Detroit, Mich.*, 924, 926, 929, 931, 933.
 C. W. THOMPSON, *Kansas City, Mo.*, 924, 926, 927, 930, 931.
 PROF. COOPER D. SCHMITT, *Charlottesville, Va.*, 923, 928, 931, 933, 934.
 W. C. BINKLEY, *Cincinnati, Ohio*, 923, 925, 927, 930, 931.
 J. W. KECKLER, *Greenville, Ohio*, 923, 925, 927, 930, 931.
 R. A. LEIST, *Burton City, Ohio*, 923, 925, 927, 928, 929, 931.
 W. J. HUSSEY, *Ohio, Ill.*, 923, 924, 925, 927, 928, 930.
 A. F. PARSONS, *Arroyo Grande, Cal.*, 923, 924, 925, 927, 928, 929, 930, 931.
 B. F. FINKEL, *North Lewisburgh, Ohio*, 923, 925, 927, 928, 929, 930, 931, 933.
 J. W. PFEIFFER, *Bolivar, Ohio*, 923, 925, 927, 928, 929, 930, 931, 932, 933.
 A. L. FOOTE, *Merrick, N. Y.*, 923, 924, 925, 927, 929, 930, 931, 933, 934.
 Please to accept our thanks, gentlemen, for your elegant solutions.

Problems for Solution.

950. From one corner of a rectangular pyramid 6 by 8 feet, it is 13 feet to the top or apex; find the dimensions of a rectangular solid whose dimensions are as 2, 3 and 4, that may be equivalent in volume.

951. I have two amalgams of the same bulk, each composed of mercury and gold, one in the ratio of 2 to 9 and the other 3 to 19. If they are fused together, what will be the ratio of mercury to gold in the resulting mixture?

952. A owes B \$1000, but is able to raise only \$600; with this he proposes to pay part of the debt, and the interest in advance on the remainder, on his note for 2 years at 10%. For what sum must he give his note at simple interest? at compound interest?

953. Bought 45 hogs at \$15 a head, and sold 15 at a certain gain per cent, 15 more at twice that gain, and the remainder at a profit of 25%. Had I sold the last lot for \$8.75 more, my gain on the entire sale would have been 10%. What was my total gain?

954. A borrows \$3600 in two notes, at the respective rates of $6\frac{1}{2}\%$ and 7% per annum; he pays the two notes at the end of eight months, with interest amounting to \$158; find face of each note.

955. Bought 400 pounds tea and 1600 pounds sugar. A pound of sugar cost me $\frac{1}{2}$ as much as a pound of tea. Sold the tea at a gain of $33\frac{1}{3}\%$ and the sugar at a loss of 20%. Find the investment if my entire gain is \$60.

956. A solid metal ball, 4 inches radius, weighs 8 lb.; what is the thickness of a spherical shell of the same metal weighing $7\frac{1}{2}$ lb., the external diameter of which is 10 inches?

957. A dealer in pork made \$1565 net, deducting 10% commission and paying \$850 expenses of packing; if the pork cost him 7 cts. a pound, how many pounds did he pack?—*Kansas State List.*

958. What relative quantities of gold and silver, whose specific gravities are $19\frac{1}{2}$ and $10\frac{1}{2}$, will make a compound whose specific gravity shall be 16.84?

A. J. BUSSARD.

We desire to continue our biographical sketches of contributors to this department. All who may solve the above shall be introduced in an early issue by a brief sketch in connection with those of Geo. Newbauer, S. G. Cagwin and Artemas Martin, not published before. Solutions should be received by Dec. 1. The problems are all by request.

EXAMINATION QUESTIONS.

USED AT GREENVILLE, OHIO, OCT. 2.

ARITHMETIC.

1. Bought 8% stock at 10%; find my rate of interest.

Ans.—I received 8% of the face value and paid 110%; hence my rate of interest is $8 \times 100 \div 110 = 7\frac{2}{11}\%$.

2. The area of a square and a circle are each one acre; find the difference of their boundaries.

Ans.—The boundary of the square is $\sqrt{160} \times 4 = 50.596$ rd. We get the area of a circle by dividing the square of half the circumference by 3.1416. Reversing this rule, we have $\sqrt{(160 \times 3.1416) \times 2} = 44.84$ rd., the boundary of circle, and the required difference is 5.756 rd.

3. Reduce $\frac{3}{4}$, $\frac{6}{11}$, and $\frac{3}{4}$ to fractions having a common numerator.

Ans.—The L. C. M. of the numerators is 120, and multiplying both terms of the first fraction by $120 \div 3$, or 40, of the second by 20, of the third by 8, and of the fourth by 5, we get $\frac{120}{110}$, $\frac{120}{220}$, $\frac{120}{110}$, $\frac{120}{55}$, respectively.

4. One-half of $\frac{4}{5}$ of what number is 5 less than $\frac{5}{6}$ of 45?

Ans.—The number must be $20 \div \frac{2}{3} = 50$.

5. When flour is \$5 a barrel the 10-cent loaf weighs 30 oz.: what should it weigh when flour is \$6 a barrel?

Ans.—The 10-cent loaf should weigh $\frac{5}{6}$ of 30 = 25 oz.

6. By discounting a note at 10% per annum, I get 15% per annum; how long does the note run?

Ans.—Since 10% of the face of the note equals 15% of the proceeds, the proceeds must be $\frac{10}{15}$ or $\frac{2}{3}$ of the face and the discount must be $\frac{1}{3}$. The discount for one year at 10% is $\frac{1}{10}$; hence the time required is $\frac{1}{3} \div \frac{1}{10} = 3\frac{1}{3}$ yr.

7. A sold two houses for \$450, receiving $\frac{4}{5}$ as much for the first as for the second; on the first he gained 25%, and on the second he lost $16\frac{2}{3}\%$; did he gain or lose on both, and how much?

Ans.—For the first he receives $\frac{4}{5}$ of \$450 = \$200, and paid $\$200 \div 1.25 = \160 ; for the second he received $\frac{5}{7}$ of \$450 = \$250, and paid $\$250 \div .83\frac{1}{3} = \300 ; the loss is $(\$300 + \$160) - \$450 = \10 .

8. The G. C. D. of three numbers is 12, and their L. C. M. is 432; find the numbers.

Ans.—We have $432 \div 12 = 36$, which is $1 \times 2 \times 18$, $1 \times 3 \times 12$, or $1 \times 4 \times 9$, making three sets of numbers; by multiplying each set of factors by the G. C. D., we get 12, 24 and 216; 12, 36 and 144; and 12, 48 and 108 which are the numbers.

9. A boat makes 12 miles an hour down stream and 8 up; how far can it go and return in $5\frac{1}{2}$ hours?

Ans.—To go one mile and return takes $\frac{1}{8} + \frac{1}{12} = \frac{5}{24}$ of an hour, and to be gone $5\frac{1}{2}$ hours, the boat may go $5\frac{1}{2} \div \frac{5}{24} = 26.4$ mi. Or, to go 12 miles and return takes $2\frac{1}{2}$ hours; hence $2\frac{1}{2} : 5\frac{1}{2} :: 12 : (26.4 \text{ mi.})$

10. A hollow cylinder 6 ft. long, whose inner diameter is one inch and outer diameter two inches, is transformed into a hollow sphere, whose outer diameter is twice its inner diameter; find outer diameter.

Ans.—Area of solid end of cylinder is $(2^2-1^2)\times\frac{1}{2}\pi=\frac{3}{2}\pi$. The solid part of cylinder contains $\frac{3}{2}\pi\times 72=54\pi$ cu. in., which makes up the solid part of sphere. The hollow part of sphere is similar to the whole sphere, and the ratio between the diameters being 2, the ratio between the contents of hollow part and the sphere must be $2^3=8$. Therefore, the solid shell of sphere contains $8-1=7$ times as much volume as the hollow part, and we have $\frac{54}{7}\pi$ cu. in. for the hollow part and $8\times\frac{54}{7}\pi=4\frac{2}{7}\pi$ cu. in. for the sphere, whose diameter is easily obtained by dividing contents by $\frac{1}{6}\pi$ and extracting cube root; thus outer diameter is $\sqrt[3]{(4\frac{2}{7}\pi\div\frac{1}{6}\pi)}=\sqrt[3]{2\frac{5}{7}\pi}=\sqrt[3]{\frac{14}{7}\pi}=\sqrt[3]{2\pi}=1.27008=7.18$ in. The inner diameter is $\frac{1}{2}$ of $7.18=3.59$ in.; or as before $\sqrt[3]{(\frac{54}{7}\pi\div\frac{1}{6}\pi)}=\sqrt[3]{\frac{81}{7}\pi}=\sqrt[3]{15876}=3.59$ in.

NOTE.—Those who can not use π ($\pi=3.14159265$), should study the above. We perform all the work without using 3.14159265 or $\frac{349}{113}$. Generally, $\frac{1}{2}\pi$ is taken instead of .7854 and $\frac{1}{6}\pi$ instead of .5236 as the books give. Operations are thus made: $3\times\frac{1}{2}\pi=\frac{3}{2}\pi$; $\frac{3}{2}\pi\div\frac{1}{2}\pi=3$; $\pi\div\pi=1$.

GRAMMAR.

1. What is grammar?

Ans.—As a science it is a system of principles and a collection of facts peculiar to a language; as an art it is a system of rules for the practical application of these principles to the language.

2. Frame a sentence containing a participial adjective and a participle having the construction of an adjective.

Ans.—The *thinking* mind, earnestly *applied* to a difficult task, will generally master it. A concealed weapon, bearing with it the idea of crime, was a violation of law.

3. Some verbs are used transitively or intransitively. Illustrate by example.

Ans.—The boy runs. The engineer runs his locomotive.

4. Write a sentence containing an object clause, some part of which is modified by a third-class element.

Ans.—He said, "Give me a sentence which contains an objective clause."

5. What are the elements of a sentence? Define first, second and third-class elements.

Ans.—Constituent parts thereof. The base of an element of the first class is one word; of the second class, two words; of the third class, a clause.

6. Name two distinctions between finite verbs and participles.

Ans.—Participles belong to nouns or pronouns and verbs do not; a verb asserts an action, being or state and a participle does not.

7. When is a verb in the singular number? When in the plural?

Ans.—Verbs agree with their subjects in number.

8. Liberty was *theirs* as *men*: without it they did not esteem themselves *men*.

Ans.—*Theirs* is a possessive pronoun, representing both the possessor and the thing possessed; it is in the possessive case, possessing *liberty* understood. A parallel expression—The idea was *Harvey's*. We parse *Harvey's* in the possessive case, possessing *idea* understood.

As is a conjunction, joining *men* and *theirs*.

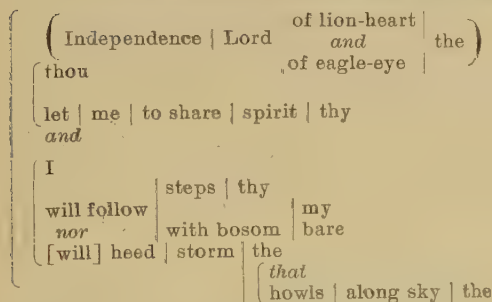
Men is a common noun, of the masculine gender, third person, plural number, possessive case, in apposition with *theirs*. The last *men* is in the objective case, the attributive object of *did esteem*.

9. I know *him* to be a sailor.

Ans.—This is an abridged proposition, equivalent to *I know that he is a sailor*; of which *I* is the subject, *know* the predicate, and what follows is the object. In the abridged proposition *him* is the base, modified by *to be-sailor*. *To be* being used in a copulative sense, and *sailor* as the attributive object of *know*. Parallel constructions: The medicine made *him sick*; I took the gentleman *to be him*; *Whom* do you suppose *him to be*? They supposed *him to be Mr. Prætor*.

Him is a personal pronoun, of the masculine gender, third person, singular number, and in the objective case; it is the object of the verb *know*.

10. Thy spirit, *Independence*, let me share,
 Lord of the lion-heart and eagle-eye:
 Thy steps I'll follow with my bosom bare;
 Nor heed the storm that howls along the sky. — *Smollett*.



Parse italicized words in 8, 9 and 10.

Analyze 9.

Diagram 10.

GEOGRAPHY.

1. Name five peninsulas of Europe, and the countries that occupy them.

Ans.—The Scandinavian (Norway and Sweden), Spanish (Spain and Portugal), Italian (Italy), Morea (Greece) and Crimea (Russia).

2. Explain the inequality in the length of day and night.

Ans.—The days and nights are always equal on the equator because the plane of the daily apparent path of the sun throughout the whole year is equally divided by the horizon. But as we recede from the equator, these planes do not cut each other at right angles, and consequently the days and nights become unequal, the length of day varying with the angle. It is interesting to study why the increase in the length of the day, after the winter solstice, and *vice versa* at the summer solstice.

3. In what direction do tidal waves move? Why?

Ans.—Westward, because the earth revolves on its axis from west to east.

4. On which side of the equator does most of Africa lie? What oceans surround it? What are oases?

Ans.—North side. Atlantic and Indian. Fertile tracts in low parts of the desert, clothed with vegetation and watered by springs or artesian wells.

5. Write ten lines upon the different forms of government.

ANS.—Monarchical forms of government are of two kinds; viz., absolute and limited. The former is rapidly declining and will disappear among civilized nations before many centuries pass by. The most desirable form is the Federal government, which is of two kinds. The first is that in which several independent governments form an alliance or confederation for offence or defence, from which any one may retire at pleasure. The other is like that of the U. S., which, of all forms, is the highest and most complicated in its organization, having one general government for the protection and mutual good of all, and securing to each state, city, township or other municipal corporation, a local government for domestic purposes.

6. Give the termini of the Atlantic cable.

ANS.—Since there are now eight Atlantic cables, the termini of three of which are Heart's Content and Valentia, it is difficult to determine which is meant.

7. By the last census, what is the area and population of Ohio? Of Darke county?

ANS.—The land area of Ohio is 40,760 sq. mi., and the water area 300 sq. mi., making the entire area 41,060 sq. mi. The population in 1880 was 3,198,062, of whom 1,613,936 were males. The area of Darke county is 588 sq. mi., and the population in 1880 was 40,833.

8. What is the orbit of the earth? Does it differ from a circle?

ANS.—It is the path of the earth around the sun, forming an ellipse with the sun in one of the foci.

9. Of what use are mountains and rivers?

ANS.—Mountains condense vapor, supply streams, purify the air, form a protection against storms, add beauty to natural scenery, produce timber, minerals, etc. Rivers drain a country of its water and filth, afford means for transportation of commodities and for the supply of fresh fish.

10. Explain carefully how you would teach a class beginning in geography.

ANS.—Commence with the school premises, drawing map and giving relative size, location and direction of objects. Then enlarge the work by the addition of the surroundings, finally embracing the whole district, township, county and state. The pupil will then have a true conception of the facts stated in the books.

HISTORY.

1. In whose administration and when was Louisiana acquired? Texas? California? Alaska? Gadsden Purchase?

ANS.—La. in Jefferson's. For full particulars see Vol. 6, pp. 165 and 217. Texas in Polk's administration, the Texan legislature ratifying the "Annexation Bill" passed by Congress, July 4, 1845. California in Polk's. The full particulars connected with the seizing of Cal. by the U. S. may never be fully known, but it became the property of the U. S. by treaty, in March, 1848. Alaska in Johnson's, May 20, 1867. Gadsden Purchase, negotiated by Jas. Gadsden in 1853 (Pierce's).

2. Name the Presidents not chosen by the Electoral College; also those that died in office.

ANS.—See page 106.

3. What are the qualifications of the members of each branch of Government, and how are they chosen?

Ans.—The President must be 35 years old; a natural born citizen; and a resident of the U. S. 14 years. Chosen by electors.

Senator must be 35 years of age; citizen of the U. S. 9 years; and resident of state in which he is chosen by the legislature. Representative must be 25 years old; citizen 7 years; and resident of his own state.

Judges of Supreme Court are appointed by the President for life or good behavior.

4. Give an account of the Gaspee.

Ans.—The *Gaspee* was a British schooner of eight guns under Lieu. Wm. Dudingston, which was lying in Narragansett Bay to prevent smuggling and created much angry feeling on the part of the people of Providence by its demands on the shipping of R. I. The *Gaspee* was accustomed to require R. I. vessels to take down their colors on their arrival. One day in June, 1772, a packet was coming in with passengers and refused to submit to the requirements of the British vessel. A chase and firing ensued, in which the *Gaspee* ran aground. That night Capt. Abram Whipple with sixty-four men removed the crew and burned the schooner.

5. Who were the Huguenots? The Walloons? The Patroons?

Ans.—The Huguenots were French protestants and followers of Calvin. The Walloons were protestant refugees of French descent, sent by the Dutch West India Company to colonize New Netherlands, in 1623. The Patroons, who were wealthy land-owners, followed in 1629. They purchased from the Dutch West India Company, under the decree called "Charter of Liberties," large tracts of land and formed colonies thereon of fifty or more persons, which they governed.

6. Give short accounts of the founding of three colonial colleges?

Ans.—Harvard, at Cambridge, Mass., was started by an appropriation of £400 by the general court of Massachusetts bay, in 1636. In 1638, John Harvard, a minister of Charlestown, died and left the college £300 and all his library. Regular instruction began this year by Nathaniel Eaton. After Massachusetts Bay, Plymouth, New Haven and Connecticut colonies united May 19, 1643, for mutual protection against the Dutch and Indians, the college prospered. The Commissioners of this league recommended in 1645 that every family in the four provinces give a peck of corn or a shilling to the institution, which was done and a healthy growth established.

In 1661 Virginia appropriated money for the establishment of a college, which was founded as William and Mary College at Williamsburgh, in 1693.

Yale College had its origin in 1700, when ten clergymen came together and deposited books, saying, "I give these books for the founding of a college in Connecticut." These gentlemen secured a charter in 1701 and an appropriation of £120 a year. The institution was located at Saybrook, but in 1717 it was removed to New Haven because more money could be raised on this condition. It was named after Elihu Yale, one of its early benefactors, who gave about £500 in all.

7. What was the object and result of the Lewis-Clarke expedition?

Ans.—Lieu. Wm. Clarke and Capt. Meriwether Lewis set out from St. Louis in March, 1804, under order of Pres. Jefferson, to explore the Louisiana Purchase. They were accompanied by 27 officers and soldiers, and some Indian interpreters. They made the trip to the Pacific Ocean and returned to St. Louis Sept. 23, 1806, having secured valuable information.

8. Give an account of boundary disputes in which the U. S. has been engaged?

Ans.—The limits of the United States were first definitely laid down in a provisional treaty with Great Britain in 1782, and similarly defined in the treaty of peace concluded Sept. 3, 1783. From that time up almost to the present the

northern boundary has been the source of dissensions and subject to a series of treaties, commissions and surveys for the purpose of interpreting the terms of the treaty of 1783. Treaties relative to this matter were signed Nov. 19, 1794 at London, Dec. 24, 1814 at Ghent, Aug. 9, 1842, at Washington, and June 15, 1846, at London. Many commissions were appointed to decide disputes, the last of which settled the boundary in the Straits of Juan De Fuca, referred to the Emperor of Germany, who decided in favor of the U. S., Oct. 21, 1872, thus finally disposing of our boundary with Great Britain.

The treaty of the cession of Louisiana to the U. S. bearing date April 30, 1803, describes the territory as being the same as ceded by Spain to France by treaty of San Ildefonso, Oct. 1, 1800, which left the limits of this vast territory very uncertain. But in the disputes which followed, the U. S. had almost her own wishes in the decisions on other claims. The purchase of Florida from Spain Feb. 23, 1819, settled the conflicting claims in that direction.

The disputes with Mexico were settled by the treaty of Guadalupe-Hidalgo, concluded Feb. 2, 1848, and proclaimed July 4, 1848. Also by the Gadsden Purchase Dec. 30, 1853.

9. Give ten dates of discovery prior to 1520, telling what was discovered and by whom.

Ans. Northern coast by Herjulfson in 986; Lief Erickson in 1001; Karlsefne in 1007; Cabots in 1497; West Indies by Columbus 1492; Florida by Ponce de Leon in 1512; Pacific Ocean by Balboa in 1513; Yucatan by Cordova in 1517; Brazil by Cabral in 1500; Northern coast of S. A. by Vespucci, 1499.

10. Name President Cleveland's Cabinet.

Ans.—T. F. Bayard, Sec'y of State; Daniel Manning, Sec'y of Treasury; W. C. Endicott, Sec'y of War; W. C. Whitney, Sec'y of Navy; L. Q. C. Lamar, Sec'y of Interior; W. F. Vilas, P. M. General; A. H. Garland, Attorney General.

SPELLING.

Crystallize, partial, fascinate, caucus, lien, excel, auxiliary, preceded, hydrophobia, dimnal, compel, strychnine, guerrilla, repel, condescend, waltz, banana, obscene, hibenial, transient.

Editorial Notes.

Grammar Department is crowded out this month, but in the new department of *Language and Literature*, we shall make up all losses.

The *Visitor* is mailed about the first of each month, and subscribers should notify us promptly, if they do not receive it. The December issue will contain a full index to Vol. 7.

The illustrations in this number will be a great help to the learner. Hereafter we shall give diagrams to all problems requiring them. Contributors will please give diagrams if necessary.

Hon. J. H. Drummond says, in reference to his solution of the stump-and-stone problem, p. 213: "Of course my solution gives another set of values. Since $z = u + s$, either u or s may be zero, and x be integral; but if s is zero, u will be negative, and if u is zero, s will be 40; so u may be either 39 or 40, and $x = 49$ or 40; therefore $y = 1550$ or 1600."

We agree to bind *Visitors* for subscribers at 25 cents per annual volume, if delivered at this office on or before Dec. 15, or left in care of Examiner J. M. Bickel, Greenville, before said date. The binding will be in full cloth, substantial and neat. The price does not include postage or expressage. Vols. 1, 2 and 3, 4 and 5, and 6 and 7, should be bound together, making three excellent books.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

983. Who invented the sword?

ANS.—Epeus, an artist who made the Trojan horse and invented the sword and buckler. See Mythological and Classical Names. *American Popular Dictionary*.
N. W. COOL, Laura, Ohio.

1011. Give an account of the Aroostook War.

ANS.—The treaty of 1787 with Great Britain fixed the boundary line between New Brunswick and Maine on the highlands which divided the waters of the St. John River from those of the Restigouche. Under that treaty Maine claimed all the territory west of the St. John River. New Brunswick first claimed that the boundary was at the Kennebec, then at the Penobscot, and finally at the St. Croix. In the winter of 1837, New Brunswick lumbermen cut logs on the Aroostook River, whereupon the sheriff of Penobscot, Mr. Strickland, Land Agent McIntyre and Rines, a lumberman, went there to arrest the invaders. But instead the provincial lumbermen arrested these and took them to St. John on a sled. They were paroled, but the circumstance aroused the people of Maine. The Governor called out 2,000 militia. They drove out the lumbermen and built a fort. The Governor of New Brunswick likewise called out his troops, but the President sent Gen. Winfield Scott to the scene, who arranged an armistice. England sent out a minister specially to settle the matter. The Webster-Ashburton treaty was the result, which established the present boundary. See p. 154. EDITOR.

1029. Who was the first colored voter in the United States? What is stamped on both sides of the medal he wears?

ANS.—The first colored voter in the U. S. was Thomas Patterson. Stamped on the face of the medal is a likeness of Pres. Lincoln. On the obverse side is this inscription: "Presented by the citizens of Perth Amboy, N. J., to Thomas Patterson, the first colored voter in the United States, under the provisions of the fifteenth amendment. Election held in that city March 31, 1870." A great speech was made for the Prohibition party, during their convention held at Newark, N. J., May 27, 1886, by an aged colored man (Patterson). "who wore a massive gold medal hanging from the lapel of his coat." The address was a radical one. JOHN YOUNG.

1030. Who possesses the pen with which President Cleveland signed the Blair Bill recently?

ANS.—President Cleveland, after signing Senator Blair's scientific temperance educational bill, known as the Blair Bill, which passed the Senate unanimously and the House with only 8 votes against it, presented to Mrs. Mary H. Hunt, Superintendent of the Department of Scientific Temperance Instruction of the National W. C. T. U., the pen with which he performed the act. To this lady belongs the honor of having secured the adoption of the first distinctively temperance measure that has ever passed Congress. The measure becomes a law just as Mrs. Hunt wrote it, as a Congressman expressed it, with every *i* dotted and every *t* crossed; certainly a remarkable thing to be said, in this busy, bustling age, of any piece of legislation. JOHN YOUNG.

1031. What special training in oratory had Henry Clay? L. B.

ANS.—Henry Clay said: "I owe my success in life to one single fact; namely, that at an early age I commenced, and continued for some years, the practice of daily reading and speaking the contents of some historical or scientific book. These off-hand efforts were sometimes made in a corn-field; at others,

in the forest, and not infrequently in some distant barn, with the horse and ox for my only auditors. It is to this that I am indebted for the impulses that have shaped and moulded my entire destiny."

W. W. Woods.

1032. How many perfect squares can be formed, using the nine digits in each number? Id.

Ans.—It is said there are twenty-eight numbers only, the squares of which contain the nine digits, as follows:

11826 ² = 139,854,276	19629 ² = 385,297,641	24807 ² = 615,387,249
12363 ² = 152,843,769	20316 ² = 412,739,856	25059 ² = 627,953,481
12543 ² = 157,326,849	22887 ² = 523,814,769	25572 ² = 653,927,184
14676 ² = 215,384,976	23019 ² = 529,874,361	25941 ² = 672,935,481
15681 ² = 245,893,761	23178 ² = 537,219,684	26409 ² = 697,435,281
15963 ² = 254,817,369	23439 ² = 549,386,721	26733 ² = 714,653,289
18072 ² = 326,597,184	24237 ² = 587,432,169	27273 ² = 743,816,529
19023 ² = 361,874,529	24276 ² = 589,324,176	29034 ² = 842,973,156
19317 ² = 375,468,129	24441 ² = 597,362,481	29106 ² = 847,159,236
19569 ² = 382,945,761		

EDITOR.

1033. Give a brief description of Wayne's treaty with the Indians at Greenville, naming the different tribes and chiefs. B. S. D.

Ans.—On the 3d of August, 1795, Wayne concluded a treaty of peace with the Indians, at Greenville. The number of Indians present was 1130, viz.: 180 Wyandots, 381 Delawares, 143 Shawnees, 45 Ottawas, 46 Chippewas, 240 Pottawatomies, 73 Miamis and Eel River, 12 Weas and Piankeshaws, and 10 Kickapoos and Kaskaskias. The principal chiefs were Tarhe, Buckongehelas, Black Hoof, Blue Jacket and Little Turtle.

Most of the chiefs had been tampered with by M'Kee and other British agents; but their people, having been reduced to great extremities by the generalship of Wayne, had, notwithstanding, determined to make a permanent peace with the "Thirteen Fires," as they called the federal states. The basis of the treaty of Greenville was, that hostilities were to cease and all prisoners be restored. Article 3d defined the Indian boundary as follows: The general boundary line between the lands of the United States and the land of the said Indian tribes shall begin at the mouth of the Cuyahoga River, and run thence up the same to the portage between that and the Tuscarawas branch of the Muskingum, thence down that branch to the crossing-place above Fort Laurens, thence westerly to a fork of that branch of the Great Miami River, running into the Ohio, at or near which fork stood Loramie's store and where commenced the portage between the Miami and St. Mary's river, thence southerly in a direct line to the Ohio, so as to intersect that river opposite the mouth of Kentucky or Cuttawaw River.

The following are the reservations within the limits of Ohio, granted to the Indians by this treaty:

1st, One piece of land, 6 miles square, at or near Loramie's store, before mentioned. 2d, One piece, two miles square, at the head of the navigable water or landing on the St. Mary's River, near Girty's town. 3d, One piece, six miles square, at the head of the navigable water of the Auglaize River. 4th, One piece, six miles square, at the confluence of the Auglaize and Miami Rivers, where Fort Defiance now stands. 8th, One piece, twelve miles square, at the British fort on the Maumee at the foot of the rapids. 9th, One piece, six miles square, at the mouth of said river, where it empties into the lake. 10th, One piece, six miles square, upon Sandusky lake, where a fort formerly stood. 11th, One piece, two miles square, at the lower rapids of the Sandusky River.

These, with the other tracts, were given "for the same considerations, and as an evidence of the returning friendship of the said Indian tribes, of their confidence in the U. S., and desire to provide for their accommodation, and for that convenient intercourse which will be beneficial to both parties."

A second treaty was concluded at Greenville July 22, 1814, with the Wyandots, Delawares, Shawnees, Senecas and Miamis. The commissioners on the part of the United States, were Gen. William Henry Harrison and Gov. Lewis Cass. By it, these tribes engaged to aid the U. S. in the war with Great Britain and her savage allies. The prominent chiefs were Tarhe, Capt. Pipe and Black Hoof. Both of these treaties were held on the same spot, within the garden of Abraham Scribner, in Greenville in 1840. On the 22d of July, 1840; just 26 years after the last treaty, there was a great celebration at this place, called the "Greenville Treaty Celebration," at which the many thousands present were addressed at length by Gen. Harrison. S. B. & J. W. KECKLER.

1035. What fish goes a-fishing with rod, line and bait? *Id.*

Ans.—The Angler Fish, Sea Devil, or Fishing Frog is a hideous looking creature, growing sometimes seven feet long and resembles a huge tadpole, its head being much larger than its whole body, with a mouth a yard wide and the under jaw longer than the upper. There are long, cane-like filaments, beautifully set in a ring and staple joint, rising from the head which it uses as fishing lines. At the end of these singular appendages is a little piece of flesh which looks like a worm floating above the animal's lurking place. The young fishes mistakingly seize this, and are sucked in by the hideous monster and devoured in the huge jaws of this natural angler. HARRY A. GILBERT.

1036. How do spiders fly in the air? S. A.

Ans.—Some small gossamer spiders speed through the air buoyed up by their light threads. WILL DAVIDSON.

Yes, when this little creature perceives that the thread is long enough and the wind sufficient, she flies away on her gossamer like a witch on a broom-stick. But how does the air buoy it up? A writer in the *Boston Journal of Chemistry* says that it is the action of the sun's rays on the thread itself and its surrounding envelope of air, and that the thread with its adhering envelope of warmed air, constitutes a quasi-balloon on which the spider sails away. The same theory explains the buoyancy of any minute particles of dust or smoke. So long as the sun shines they absorb its rays, become warmer than the air, and surround themselves with a buoyant envelope, which will carry them in the air, if not too heavy in proportion to their surface. EDITOR.

1037. Give the natural history of the wood worm. *Id.*

Ans.—They come from the eggs of several species of flies, and being provided with very hard and sharp cutting jaws, they proceed at once to bury themselves in the substance of the wood. They cut the wood into a very fine powder, and in passing through their digestive organs the nutritive portion is extracted for the growth of the body. After living in the wood for a time, they tunnel to the surface and drop to the ground into which they descend to assume the pupa state, and gradually change into a fly. EDITOR.

1038. Why do the signs of the subtrahend change? SUBSCRIBER.

Ans.—It is understood that the subtrahend is considered a subtractive quantity, and when positive it can be written with the sign — before it; thus, subtract $4a$ from $5a$ and we have $5a - 4a = a$. But suppose we wish to subtract $-4a$ in the expression $5a - (-4a)$. Let $5a = m$ and $(-4a) = -s$, and $d =$ the difference. Then $m - (-s) = d$, and by adding $(-s)$ to these equals, we obtain $m - (-s) + (-s) = d + (-s)$. But $m - (-s) + (-s) = m$ and $d + (-s) = d - s$. Therefore $m = d - s$, and it follows that $m - s$ is greater than m by the additive quantity s , or it is equal to $m + s$. Then $5a - (-4a) = 5a + 4a = 9a$.

1039. Describe the plant called *Alfalfa*. Where found? *Id.*

Ans.—Lucern (*Medicago Sativa*) is a forage plant of the family *leguminosce*, and related to clover (*trifolium*), not only in its botanical character, but in its agricultural uses. It is known in Spain as *alfalfa*, which name it bears also in

Spanish American countries, and is still retained in California and New Mexico. The root of lucern is perennial, from which arise erect, smooth, branching stems, 2 ft. or more high; the leaves are pinnately trifoliate, the leaflets obovate-oblong, toothed; the flowers, instead of being in a dense head as in clover, are in erect racemes; the corolla is violet-purple, and the many-seeded pod is spirally coiled. Lucern has never been much grown in England or in the older United States, but on the continent of Europe and in our far southern and western states, it is regarded as of great value. The plant has very long roots, which have been known to penetrate to 12 ft. or more; hence it is quite unsuited to light, thin soils with a poor subsoil. Like clover and other leguminous plants, it draws largely upon the atmosphere for its sustenance, and its wide-spreading roots in their decay enrich the soil with vegetable matter, while they at the same time mechanically disintegrate it. Its great value is as a soiling crop to feed in the fresh state to dairy cows and other animals; the yield in hay per acre is variously estimated at from three to eight tons.

WILL DAVIDSON.

1040. Which is the oldest railroad in Ohio?

Id.

Ans.—The first railroad in Ohio was the old Mad River & Lake Erie, extending from Springfield to Sandusky (now the Indiana, Bloomington & Western). The grading commenced at the end of Water street, Sandusky, Sept. 7, 1835, amid general rejoicing. The first engine on the road was the *Sandusky*, which was the first in America to which a steam whistle was attached. It was built at Patterson, N. J., designed by an American mechanic by the name of Swineburne. See Kennedy's *Wonders and Curiosities of the Railway*.

EDITOR.

1041. To what pressure must water be subjected to prevent it from freezing at 25° Fah.?

DEVOLSON WOOD.

Ans.—According to experiments made by Sir William Thompson and Clausius, a pressure of 120.8 atmospheres is required to lower the freezing point of water 1°C. So in the query, to lower the freezing point of water 32°—25°, or 7° Fah. = 3 $\frac{1}{3}$ °C., the required pressure is $3\frac{1}{3} \times 120.8 = 469.7777$ atmospheres. Taking 15 lb. to the square inch as an atmosphere, we have 7046.667 lb. or 3.523 tons to the square inch, the pressure required to prevent water from freezing at 25° Fah.

E. E. GILBERT, *Rose Polytechnic Institute*,

Terre Haute, Ind.

1042. Who was Toscanelli? Give biography.

AMPHIC.

Ans.—Paolo Del Pozzo Toscanelli, keeper of Florentine Library, was born at Florence in 1397. He was an Italian astronomer of some note, and constructed the famous gnomon on the cathedral at Florence. He formed a project to shorten the route to China by navigating westward, and wrote to Columbus about 1474, confirming him in his ideas of a westward voyage to Cathay. He died in 1482.

H. W. HOLYCROSS.

1043. What and where were the mines of Hispaniola to which DeAyllon had intended to take his kidnapped Indians?

Id.

Ans.—Columbus landed on the island of Hayti, Dec. 6, 1492, which he found inhabited by at least a million friendly but feeble natives. He called the island Espagnola (Little Spain), which was Latinized into Hispaniola. Under Spanish cruelty for fifteen years, being subjected to intolerable labor in the gold-mines and under the task-master's lash, these enslaved natives were reduced to 16,000. To supply the deficiency of laborers, the Spanish decoyed into Hispaniola 40,000 inhabitants of the Bahamas, and in 1517 a royal edict authorized the importation from Africa of 4,000 slaves a year. In 1520 DeAyllon, driven by storm to the coast of South Carolina, undertook to speculate in the traffic, and kidnapped a number of Indians, as slaves for those gold-mines; but the liberty-loving red men preferred death to slavery and died of voluntary starvation.

EDITOR.

1044. Whence come our buttons, cork and sponges? LAURA.

Ans.—Birmingham, Eng., is the most noted place in the world for the manufacture of buttons. In this country it is extensively carried on in Waterbury, Conn., and in Easthampton, Mass.

Cork oak (*quercus suber*) grows abundantly in Spain, Portugal, Algeria, and the south of France. Commerce is indebted to Portugal for its largest supply.

Smyrna is the chief place for the export of fine sponges. The coarse sponges used for horses, carriages, etc., are obtained chiefly from the Bahamas.

WILL DAVIDSON.

1045. How is the substance called *Lac* produced? Id.

Ans.—*Lac* is a resinous substance produced mainly by the scale-shaped insect *Coccus Lacca*, the female of which fixes itself in the bark of trees and exudes from the margin of the body this resin. *Stick Lac* is the substance in its natural state, incrusting small twigs. When broken off and boiled in alkaline water the residuum is called *Seed Lac*, and when reduced to a thin crust it is called *Shell-Lac* (shellac), which is the principal ingredient in sealing wax and lacquers.

NOAH A. WARE.

Lac is the general name under which the various products of the *Lac* insect are known. The curious hemipterous insect which yields these valuable contributions to commerce is in many respects like its congener, the cochineal insect, but it also differs essentially from it. They live upon the twigs of trees, chiefly the species of *Butea*, *Ficus* and *Croton*, and soon entomb themselves in a mass of matter which oozes from small punctures made in the twigs of the tree, and which thus furnishes them with both food and shelter. These small twigs, when well covered, are gathered by the natives and placed in hot water, which melts the resinous matter, liberates the pieces of wood and the remains of the insects, and also dissolves the coloring matter. This is facilitated by kneading the melted resin while in the hot water; it is then taken out and dried, and afterward put into strong and very coarse cotton bags, which are held near enough to charcoal fires to melt the resin without burning the bags. By twisting the bags, the melted resin is then forced through the fabric, and received in thin curtain-like films upon strips of wood. This hardens as its surface becomes acted upon by the air, and, being broken off in fragments, constitutes the shellac of commerce. The best shellac is that which is most completely freed from impurities, and approaches most to a light orange brown color.

H. W. HOLYCROSS.

Lac is produced by an insect. As soon as the minute insects make their appearance they fasten in pyramids on the young shoots, and, inserting their long proboscides into the bark, draw their nutriment from the sap of the plant. The insects begin at once to exude the resinous secretion over their entire bodies, which forms in effect a cocoon, and the separate exudations coalescing, a continuous hard resinous layer, regularly honeycombed with small cavities, is deposited over and around the twig. From this living tomb the female insects, which form the greater bulk of the whole, never escape. After their impregnation, which takes place on the liberation of the males, about three months from their first appearance, the females develop into a singularly amorphous-like organism consisting in its main features of a large, smooth, shining, crimson-colored sack, the ovary, with a beak stuck into the bark, and a few papillary processes projected above the resinous surface. The red fluid in the ovary is the substance which forms the lac-dye of commerce, and, when the young are allowed to hatch out, the greater part of this coloring matter is lost, and only a dead resinous matter is left on the twig. To obtain the largest amount of both resin and dye-stuff it is necessary to gather the twigs with their living inhabitants in or near June and November. The greatest amount of lac is produced in India.

J. W. KECKLER.

The Hindoos use the lac-dye to paint houses, and the color of the red leather of Nurple is due to this dye. The Arabians use it as an unguent. EDITOR.

1046. Give the origin of names of our leading fabrics. *Id.*

Ans.—Sir Geo. Birdwood says that buckram is derived from Bochara; cambric from Cambrai; damask from Damascus; satin from Zaytown, in China; calico from Calcutta; muslin from Mosul; shawl, from the Sanscrit *sala*, floor, for shawls were first used as carpets; delaine from the French, meaning of wool; velvet from the Italian *vellute*, woolly.

EDITOR.

1047. What new theories did Darwin the scientist produce? Give a sketch of his life and where buried. *CURIOUS.*

Ans.—Darwin contends that the various species of plants and animals, instead of being each especially created and immutable, are continually suffering change through a process of adoption, by which those varieties of a species that are in any way better fitted for the conditions of their life, survive and multiply at the expense of others. So potent and universal does this process of natural selection seem to be, that Darwin considers it capable, with other less important causes of explaining how all existing species may have descended from one or a very few low forms of life.

Charles Darwin, an English naturalist of the highest eminence, was born at Shrewsbury in 1809, and died in 1882. Darwin's whole life, so far as his surroundings permitted, was solely devoted to scientific researches.

A. L. MENDENHALL.

This great author of the *Origin of Species through Natural Selection* was buried at Westminster Abbey, April 26, 1882. James Russell Lowell, U. S. Minister to England, was one of the pall-bearers.

EDITOR.

1048. To how many full moons is the sun's light equal? *W. LOY.*

Ans.—The light of the sun is equal to 5,563 wax candles held at a distance of one foot from the eye. It would require 800,000 full moons to produce a day as brilliant as one of cloudless sunshine. Yet only one twenty-three hundred millionth part of the sun's light and heat reaches the earth.—*Steele.*

W. C. BINKLEY.

1049. What was the "Property taken at the siege of Sevastopol"? *C. W. BRUMBAUGH.*

Ans.—The answer to this query is but an addition to that of No. 896. After the emigrants were all murdered by the Mormons and Indians, they divided the property between themselves; that is, the Mormons sold to the Indians what they did not want themselves. Mrs. Fanny Stenhouse, in her book, "Tell It All," says: Most of the property of the emigrants was sold by public auction in Cedar City. The Indians got most of the flour and ammunition, and the Mormons the more valuable articles. They jested over it and called it "Spoil taken at the siege of Sevastopol." There is legal proof that the clothing stripped from the corpses, blood-stained, riddled by the bullets, and with shreds of flesh attached to it, was placed in the cellar of the titling office, where it lay about three weeks, when it was privately sold. The cellar is said to have smelt of it for years. Soon after this time, jewelry torn from the mangled bodies of the unfortunate women was publicly worn in Salt Lake City, and every one knew whence it came. A titling of it all is reported, upon very conclusive evidence, to have been laid at the feet of Brigham Young. *JNO. H. KNIESLY.*

1050. Who were the leaders in the secession movement? *JULIUS A. SHEETS.*

Ans.—The secession movement is now commonly regarded as a conspiracy, entered into by the radical leaders of Southern politics. Had the spectre of a Southern national government and the inevitable war which followed, been as familiar to Southern voters as to the conspirators, no state except South Carolina could have been carried into secession. Gov. Gist's confidential letter to other Governors of the South in Oct., 1860, showed that even S. C. would not go into secession alone. The secret meeting of the senators of the seven orig-

inal seceding states, at Washington, Feb. 5, 1861, in which Jefferson Davis, Mason, Slidell, Benjamin and Wigfall figured largely, has been considered the source of the conspiracy.

GALEN.

1051. What form of government have the following countries:
Nepal Bliotan, Mosquito Reserve?

NOAH A. WARE.

Ans.—The Mosquito Reserve stretches along the Caribbean Sea from Monkey Point to the Tinto River, and inland about 40 miles bounded on the west by Nicaragua. It enjoyed a semi-independent position under the nominal protection of Great Britain from 1655 to 1850. By the Clayton-Bulwer treaty of 1850 England resigned her claims, and by the treaty of Managua in 1860 ceded the protectorate to Nicaragua. The chief accepting this relation with Nicaragua died in 1864, since which time the suzerain state has never recognized his successor. The reserve continues to be ruled by a chief elected by the natives (Mosquito Indians) assisted by an administrative council, which assembles at Bluefields, the capital. Its government is therefore democratic in form.

Theoretically, Nepal has a despotic government; practically, for the last century, all real power has been in the hands of a prime minister and his faction. The Nepalese assert their independence, but at the same time they acknowledge the supremacy of China, and in their foreign relations Great Britain wields a powerful influence over them.

EDITOR.

1052. Who discovered the planet Vulcan? Describe it. *Id.*

Ans.—Vulcan is a planet supposed by some to exist between Mercury and the sun. The following are the circumstances connected with its supposed discovery: On the 26th of March, 1859, a small dark body was seen to pass over a portion of the sun's disc, by M. Lascarbault, a French physician, but an amateur of astronomy; and this appeared to indicate to him the existence of a planet whose orbit must be included within that of Mercury. From the observations which he made with his rude instrument, he calculated its period at about 20 days; its distance 14,000,000 miles; and the inclination of its orbit, about 12°. On publishing this fact, the celebrated French astronomer and mathematician, Leverrier, visited him, and after closely questioning him as to his means and method of observation, was completely satisfied of the truth of his statement. Singular to say, however, no other observer has ever been able to detect any indication of such a planet; but on the contrary M. Liais, an astronomer of skill and experience, who happened to be engaged in observations of the sun at Rio Janeiro, at the identical moment, asserted positively that no such object was visible at that time. The existence of any planet inferior to Mercury is therefore considered very doubtful.—*Kiddle's Elementary Astronomy.*

B. F. FINKEL.

1053. Give history of the War of the Roses. A. L. MENDENHALL.

Ans.—This was a disastrous civil contest which desolated England during the thirty years from 1455 to 1485, sacrificing eighty princes of the blood and the larger proportion of the ancient nobility of the country. It was so called because the two factions which upheld the two claims to the throne of the Houses of York and of Lancaster wore badges of white and red roses respectively.

J. D. BEARD.

1054. Why is the circular edge of the New Moon brighter than the other portion not illuminated?

M. A. BROWN.

Ans.—The circular edge receives the light of the sun, while the darker side receives only the reflected light of the earth.

NOAH A. WARE.

1055. What are the general rules for the so-called lightning method as applied to adding columns?

L. M. ORLADY.

COMMENT.—We know of no general rules except what are based on the principle of tens or multiples of tens. Will some one answer fully?

EDITOR.

1056. What President was the adopted son of Robt. Morris? *Id.*

Ans.—It is a mistake that William Henry Harrison was the adopted son of Robert Morris. Harrison was the third and youngest son of Benjamin Harrison, in a family of fifteen children. He was born in Berkeley, Va., Feb. 9, 1773, and spent an uneventful boyhood and youth. He received a liberal education at Hampden-Sydney College, and on the death of his father in 1791, he was placed under the *garrisonship* of Robert Morris. The same year, contrary to the advice of Mr. Morris, young Harrison joined the army at Ft. Washington, where Cincinnati now stands, and his subsequent career is familiar to all.

EDITOR.

1057. Where is slate mostly quarried? How?

TEACHER.

Ans.—Slates of surpassing beauty and good quality are found in Vermont, around Bangor, Me., in the Huron Mountains, Mich., and in the counties of Northampton, Pa., Washington, N. Y., Hartford, Md., and Pike, Ga. School slates are made mostly from the soft, carbonaceous slate in the great quarries at Bethlehem, Pa.

EDITOR.

1058. How is Chicago supplied with water?

Id.

Ans.—A tunnel of brick 62 inches high and 60 inches wide was built in 1864-66, which extends two miles out into the lake and about seventy feet below the surface, in order to get pure water. The first water for the supply of Chicago was admitted March 24, 1867. It was pumped dry Jan. 18, 1882, and the Mayor with the city engineer walked through the entire tunnel to the crib, Jan. 24, 1882, and found every thing in excellent order. Enormous engines capable of drawing 72,000,000 gallons daily, pump the water into an iron column 130 feet high, for the supply of the city. Additions have been since made to the works.

I. A. ELSON.

1059. Give the present rulers of European countries.

Id.

Ans.—Czar Alexander III. of Russia; King Leopold II. of Belgium; King Charles of Roumania; Emperor Francis Joseph of Austro-Hungary; King Christian IX. of Denmark; Pres. Jules Grevy of France; King William of Germany; Queen Victoria of Great Britain; King George of Greece; King Hubert of Italy; King Oscar II. of Norway and Sweden; Pres. Deucher of Switzerland; Sultan Abdul-Hamid II. of Turkey.

JOHN KRIESLY.

On the 17th of May last, a baby was born in Madrid whose birth in the magnificent palace of Charles V. was announced by the firing of cannon. In a few hours the whole civilized world knew that a son was given to the widow of Alfonso XII., and that this boy is the new-born King of Spain. Early in the day on which he was baptized, immense crowds of people gathered near the palace, eager for a glimpse of the procession on its way to the church. Soldiers led the way, after them the chief nobles of Spain; then came the nurse carrying the baby, and by her side was the papal nuncio, representing the Pope, who is the godfather of the child. The godmother followed with members of the royal family. The name given to the little fellow was Alfonso Leon Fernando Maria Santiago Isidro Pascual, and his family name is De Bourbon. He is called Alfonso XIII. for short. It is said the little King cried on receiving his long name, and had to go back to his cradle again. Until the birth of this baby, his older sister was considered Queen of Spain. EDITOR.

1060. Should music be taught in the common schools? A. T.

Ans.—I believe that vocal music should receive due attention at school. A song, combined with a few principles, each morning after opening school, would be beneficial in many ways. It would prevent tardiness and cultivate a taste for music. If the teacher, unfortunately is not a singer, there are always some pupils who can lead.

WARREN LOY.

Yes, to some extent; for if the schools do not encourage this art, we shall soon be a race of poor singers.

W. W. WOODS.

List of Contributors to this Number.

- W. W. WOODS, *Bloomertown, Ohio*, 1042, 1048, 1052, 1053, 1058.
 HARRY A. GILBERT, *Gettysburgh, Ohio*, 1031, 1045, 1056.
 WILL DAVIDSON, *Lewisburgh, Ohio*, 1031, 1045, 1049, 1058.
 PROF. I. A. ELSON, *Mapleton, Ohio*, 1053, 1056, 1058.
 J. D. BEARD, *Pymont, Ohio*, 1035, 1042, 1047, 1048, 1058.
 H. W. HOLYCROSS, *North Lewisburgh, Ohio*, 1035.
 NOAH A. WARE, *West Manchester, Ohio*, 1036, 1056, 1058.
 A. L. MENDENHALL, " " 1042.
 S. B. KECKLER, *Weaver's, Ohio*, 1042, 1048, 1053, 1056, 1058.
 QUERISTS.—L. M. ORLADY, *McConnellstown, Pa.*; R. A. LEISY, *Burton City, O.*;
 F. H. GOUDY, *Laings, Ohio*; FRANK LESLIE, *Columbia City, Ind.*; JOHN YOUNG,
Packerton, Pa.; L. S. HOWELL, *New Madison, Ohio*; WARREN LOY, *Pymont, O.*;
 WM. WILEY, *86 Jefferson Ave., Detroit, Mich.*; FOREST BALES, *N. Lewisburgh, O.*

QUERIES.

1093. What is the Culinary Paradox? WILL DAVIDSON.
 1094. Give a description of Krao. Id.
 1095. Give origin of the phrase *Bloody Shirt*. L. M. ORLADY.
 1096. How long does Sunday last on the Earth? Id.
 1097. Why is the Milky Way so called? Id.
 1098. Give story of the beans of Pythagoras. Id.
 1099. What is the nebular hypothesis? R. A. LEISY.
 1100. Describe the origin of paper money in America. Id.
 1101. Explain Washington Peace Conference, 1861. F. H. GOUDY.
 1102. What and where are Nomands? Id.
 1103. How many active volcanoes? FRANK LESLIE.
 1104. Describe the Keely Motor. JOHN YOUNG.
 1105. What were the dying wishes of Frank Leslie, the publisher? Id.
 1106. Describe the lost colony of America. L. S. HOWELL.
 1107. Explain standard R. R. time. J. D. BEARD.
 1108. Why do old people become partially deaf? WARREN LOY.
 1109. Give quickest Atlantic passage on record. CURIOUS.
 1110. Was there a woman by the name of Mother Goose from whom we have *Mother Goose's Melodies* for children? Id.
 ANS.—Yes, sir; her name was Elizabeth Foster, born in Charlestown, Mass., 1665, and married Isaac Goose of Boston, 1693. She thus became the step-mother of ten children and in due time the mother of six more. See William Hoover's answer, p. 21, Vol. 4. EDITOR.
 1111. Is it true that Dr. Lardner affirmed the impossibility of navigating from Europe to America by steam? WILLIAM WILEY.
 1112. What prevented the British from destroying Perry's fleet on Lake Erie while it was under construction? S. B. KECKLER.
 1113. According to a law of philosophy a dense atmosphere is a better conductor of sound than rare. Why is it then that we can hear a noise much better when it is raining the air, of course, being rarer at the time? FOREST BALES.

Answers on or before Dec. 1.

NOTICE TO SUBSCRIBERS.

Renewals are now in order. If your subscription expires in December, please forward the dollar, or get up a club early, for which special rates are given. We shall adhere to the cash-in-advance system, and we cordially invite you to have your name placed upon the *new books* for 1887 without delay. With a large list of first-class, paying subscribers, the *Visitor* will be a grand success. Will you, kind reader, send us the addresses of friends who would be interested in our magazine, and who, by seeing a copy, might subscribe? Such favors shall be kindly remembered. Some appreciative friends have paid their subscriptions for two years ahead, and many say "Consider me a life subscriber." Others seem especially interested in our *Prospectus* for 1887, and look forward with eagerness for the good things to come. Rest assured that no one will ever regret the investment of a dollar in the *Visitor* for 1887. See *Prospectus*.

Notices of Books, Magazines, Etc.

The November number of DEMOREST'S MONTHLY is at hand and a fine number it is, containing a beautiful oil picture, "The Music Lesson," besides fifty other illustrations. Its literary departments are instructive as well as amusing, and its fashion department is just what is wanted in these hard times, as each number contains an order entitling the purchaser to select a pattern of any design in that number and of any size. Our lady readers who wish to economize will appreciate this, for while they get the finest literary Magazine in the world at only \$2 per year, they also get all the patterns they wish to use (free), from the recognized fountain-head of fashions.

HOW TO STRENGTHEN THE MEMORY; OR, NATURAL AND SCIENTIFIC METHODS OF NEVER FORGETTING. By M. L. Holbrook, M. D. Price \$1.00. New York: M. L. Holbrook & Co.

The author of this book believes that the memory can be strengthened so as to be many times stronger than it would be without culture, and he goes to work in a plain, straightforward way to point out the most suitable methods. There are chapters on The Memory of the Aged; The Memory of Names and Localities; The Musical Memory; The Culture of Memory in Schools; The Lawyers' and Clergymen's Memory; The Relation of the Health; Memory of Forms and Faces; Best Methods of Cultivating the Memory for Words, and How to Learn a New Language. The work may be very highly commended to all classes of persons, be they young or old, learned or unlearned. The paper, presswork and binding are unusually good.

SADLER'S COMMERCIAL ARITHMETIC, for Common Schools. W. H. Sadler, Baltimore, Md. Price to teachers, 60 cents. Retail price, \$1.00.

This volume is designed to give the best methods of computation as taught in Business Colleges, and consequently we have minimum of theory and maximum of practice. All purely speculative and difficult problems are omitted, and a variety of easy, practical exercises furnished, thus enabling the pupil of mediocre talents to receive what is sometimes attainable only by the intelligent few. The first part of the complete edition, extending to percentage, is published separately for the benefit of the lower grades. Most liberal terms for introduction and exchange are offered. Correspondence is solicited. Address the publisher.

THE FIRST THREE YEARS OF CHILDHOOD. By Bernard Perez. Edited and Translated by Alice M. Christie. Introduction by James Sully, M. A. Published by A. N. Marquis & Co., Chicago. Price, \$1.25.

Here is a good work on infant psychology, consisting of incidents and observations, taken from the author's journals and borrowed from others' experience. It follows out the gradual awakening of those faculties of the child which constitute psychic activity, and will be read with profit by those who are to train the juvenile mind.



EDITED BY

JOHN S. ROYER.

VOL. VII.

DECEMBER, 1886.

No. 12.

PRACTICAL MATHEMATICS.

SOLUTIONS OF PROBLEMS.

935. To divide the circumference of a circle into four equal parts by aid of the dividers only. L. A. MATHIAS.

By A. L. FOOTE, Merrick, N. Y.

Let a circle be described by the dividers, and apply the radius to the circumference, dividing it into six equal parts. Then with a distance greater than half the distance between two consecutive divisions let arcs be described from each through the circumference. Double over the edge of the paper to pass through each of the intersections of these arcs, and mark the point where the edge of the paper touches the circumference, and we bisect the arc between two consecutive divisions. Thus we have $\frac{1}{2}$ of the circumference, and taking three of these division, we have $\frac{3}{4}$ of the circumference.

936. Find a triangle such that the sides and the perpendiculars from each angle to the opposite side shall be integral. J. C. ROEBUCK.

By PROF. WILLIAM HOOVER, Ohio University at Athens.

Let A, B, C be the vertices of any triangle, a, b, c their opposite sides, $2s$ their sum, r the radius of the inscribed circle, k its area, and p_1, p_2, p_3 , the perpendiculars from A, B, C upon a, b, c . Then, by trigonometry,

$$\begin{aligned} a &= r(\cot \frac{1}{2} B + \cot \frac{1}{2} C), \quad b = r(\cot \frac{1}{2} A + \cot \frac{1}{2} C), \quad c = r(\cot \frac{1}{2} A + \cot \frac{1}{2} B), \\ s &= r(\cot \frac{1}{2} A + \cot \frac{1}{2} B + \cot \frac{1}{2} C), \quad k = rs = r^2(\cot \frac{1}{2} A + \cot \frac{1}{2} B + \cot \frac{1}{2} C) \\ &= \frac{1}{2} ap_1 = \frac{1}{2} bp_2 = \frac{1}{2} cp_3. \end{aligned}$$

Therefore

$$p_1 = \frac{2r(\cot\frac{1}{2}A + \cot\frac{1}{2}B + \cot\frac{1}{2}C)}{\cot\frac{1}{2}B + \cot\frac{1}{2}C},$$

$$p_2 = \frac{2r(\cot\frac{1}{2}A + \cot\frac{1}{2}B + \cot\frac{1}{2}C)}{\cot\frac{1}{2}A + \cot\frac{1}{2}C},$$

$$p_3 = \frac{2r(\cot\frac{1}{2}A + \cot\frac{1}{2}B + \cot\frac{1}{2}C)}{\cot\frac{1}{2}A + \cot\frac{1}{2}B}.$$

Now, if $\cot\frac{1}{2}A = m \div n$, $\cot\frac{1}{2}B = p \div q$, $\cot\frac{1}{2}C = (mq + pn) \div (mp - nq)$, since in any plane triangle $\cot\frac{1}{2}A + \cot\frac{1}{2}B + \cot\frac{1}{2}C = \cot\frac{1}{2}A \cot\frac{1}{2}B \cot\frac{1}{2}C$. Let $m = 2$, $n = 1$, $p = 3$, $q = 2$; then $\cot\frac{1}{2}A = 2$, $\cot\frac{1}{2}B = \frac{3}{2}$, $\cot\frac{1}{2}C = \frac{7}{4}$, and $a = \frac{1}{4}r$, $b = \frac{1}{4}r$, $c = \frac{7}{2}r$, $p_1 = \frac{4}{13}r$, $p_2 = \frac{1}{5}r$, $p_3 = 3r$. To make these sides and perpendiculars integral, it is only necessary to make r a multiple of 4, 5 and 13. Let $r = 260$; then $a = 845$, $b = 975$, $c = 910$, $p_1 = 840$, $p_2 = 728$, $p_3 = 780$.

NOTE.— P_1 , p_2 and p_3 are used instead of p_a , p_b and p_c as in copy, for want of sorts.

EDITOR.

By A. F. PARSONS, *Arroyo Grande, Cal.*

The expressions $gh(k^2 + l^2)$, $kl(g^2 + h^2)$, $(hk + gl)(hl - gk)$ produce numbers, which, as sides of triangles, form triangles having trigonometrical functions of angles rational. By proper multiplications, these may be changed to those having perpendiculars integral. I find sides 1785, 1445, 850 will have perpendiculars 340, 420, 717, and sides 60, 50, 50 will have perpendiculars 40, 48, 48.

937. Bought a tract of land, the length of which is to the width as 8 is to 5; the price per acre in dollars is the same as the number representing the length in rods. The number of dollars paid for the land equals 13 times the number of rods around it. Required, the length and width.

R. A. LEISY.

By C. W. THOMPSON, *Kansas City, Mo.*

Let x = number of acres, and y = the common factor in the ratio of the sides; then $8y$ = length and $5y$ = width; also $\frac{4}{160}y^2$ = No. of acres, and $8xy = 13(26y)$ = cost of tract; hence $8x = 338$, and $x = 42\frac{1}{4}$ acres, the tract being 104 rds. long and 65 rds. wide, and the cost \$4394.

By GEO. C. RUSSELL, *Petaluma, Cal.*

Let $8x$ = length in rods and $5x$ = width in rods. Then $(8x \times 5x) \div 160 = \frac{1}{4}x^2$, the area in acres, and $\frac{1}{4}x^2 \times 8x = 2x^3$, cost of land. Also $2(8x + 5x) = 26x$, the number of rods around the farm, and $13 \times 26x = 338x$, cost of land. $\therefore 2x^3 = 338x$, and $x = 13$; $8x = 104$ rd. and $5x = 65$ rd.

938. From a point in latitude λ ($=41^{\circ}19'$) three horizontal lines are drawn, one due north, one due east, and one exactly northeast. What rate of change in the absolute direction of *each* of these lines is caused by the earth's rotation?

By PROF. COLMAN BANCROFT, *Hiram College, Ohio.*

Conceive a sphere (for convenience the celestial sphere,) with its centre at a point H upon the earth's surface in the given latitude λ ($=41^{\circ}19'$). From H draw the three lines respectively to the points N , E and M , in the horizon circle of this sphere. Conceive the sphere to revolve eastward around HP , drawn to the celestial pole, making one revolution in a sidereal day.

I. Now, as E moves in a great circle (the equator), HE changes its direction 15° every sidereal hour.

II. As NP = polar distance of $N = \lambda$, N moves in a small circle whose circumference equals the circumference of a great circle multiplied by $\sin \lambda$. Hence at any moment the direction of HN is changing such a rate as would, *if continued* in a plane, amount in one hour to $15^{\circ} \sin 41^{\circ}19' = 9^{\circ}54'11.88''$; or, in four minutes, to .66022 of $1^{\circ} = 39'36.79''$.

Letting HN' be the position of the line at the end of one hour, the actual difference of direction is, of course, measured by the arc NN' of the triangle NPN' , in which $NP = N'P = \lambda = 41^{\circ}19'$, and angle $NPN' = 15^{\circ}$. Solving $NN' = 9^{\circ}53'14''$.

For 4 minutes, *i. e.*, while N is moving through 1° of the small circle in which it revolves, the conical surface generated by HN curves so slightly away from the plane tangent to the conical surface in (the initial position of) HN , that the value found above is *very* nearly the actual difference of direction. Supposing HN'' to be the position of the line at the end of 4 minutes, we have, in the triangle NPN'' , $NP = N''P = \lambda = 41^{\circ}19'$, and $\angle P = 1^{\circ}$; whence arc $NN'' = \angle NHN'' = 39'36.77''$, only a small fraction of $1''$ less than 1° multiplied by the polar distance.

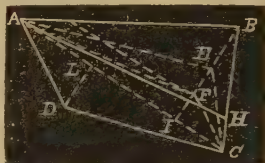
III. PM , the polar distance of M the northeast point of the horizon, is the hypotenuse of the right spherical triangle PNM , in which $\cos PM = \cos PN \cos NM = \cos \lambda \cos \text{azimuth} = \cos 41^{\circ}19' \times \cos 45^{\circ}$; therefore $PM = 57^{\circ}55'15.5''$. Then, as before, the rate of change in the direction of HM is such as would amount to $15^{\circ} \sin PM = 12^{\circ}42'35''$, if the motion continued in a plane. The actual change, calling HM' position of line at the end of one hour, gives $\angle MHM' = 12^{\circ}41'58''$.

QUERY.—Are the mathematicians satisfied with the solution of *Prob. 882*?

939. It is required to bisect a quadrilateral by a line drawn from one of its angles. H. A. WOOD.

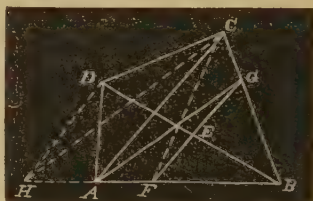
By A. F. PARSONS, Arroyo Grande, Cal.

Let $ABCD$ be the quad. to be bisected by a line drawn from the angle A . Draw diagonal AC and the perpendiculars BI and DL . In BI , the longer perpendicular, take $BE = DL$, the shorter perpendicular. Bisect EI in F , and through F draw a parallel to AC , cutting BC in H . Connect AH and it is the required line. For, the triangles ABC and ACD on the same base are to each other as their $\perp$ s $\therefore \triangle AEB + \triangle CEB = \triangle ACD$, and $\triangle AFE + \triangle CFE = \triangle ACF$, and $\triangle ACD + \triangle ACF = \triangle AFE + \triangle CFE + \triangle AEB + \triangle CEB$. But $\triangle ACF = \triangle ACH$, and $\therefore$ the quad. is bisected by AH . Q.E.D.



By B. F. FINKEL, North Lewisburg, Ohio.

Let $ABCD$ be the quadrilateral, AC and BD its two diagonals. Let E be the middle point of the diagonal BD , and through E draw FEG parallel to AC . Connect A and G . Then will AG divide the quadrilateral into two equal parts. Produce AB , and draw DH parallel to AC . The triangles HCA and DCA have the same base AC , and their vertices in the same line DH parallel to the base AC . $\therefore$ the triangles are equal, and therefore quadrilateral $ABCD = \triangle HCB$.



In the similar triangles EBF and DBH , $EB:BD=BF:BH$. But EB is half of BD , consequently BF is half of BH . $\therefore BF=HF$. Draw CF . Then will CF divide the triangle HCB into two equal parts. For the triangles HCF and FCB have equal bases and the same altitude $\therefore HCF=FCB$. But

$$HCF = (HCA = ADC) + (ACF = CAG = ACDG),$$

and $FCB = (FCG = AGF) + FGB = AGB$. $\therefore ADCG = AGB$, and the line AG divides the quadrilateral into two equal parts.

933. I marked goods to gain 60%, but on account of using an incorrect yard-stick, I gain only 40%; find length of measure. J. W. PLANTS.

By J. W. WATSON, Middle Creek, Ohio.

Let 100% = cost; then 160% is the marked price and 140%, the selling price; $\frac{1}{4} \times 10 = \frac{8}{7} = 1\frac{1}{7}$ yards, length of yard stick.

By WM. WILEY, 86 Jefferson Ave., Detroit, Mich.

J. W. P. received 1.40 instead of 1.60, which is $\frac{2}{3}$ of the proper amount. If a was the number of true yards, $\frac{2}{3}a$ was the number of false yards. $\therefore a \div \frac{2}{3}a = 1 \div \frac{2}{3} = \frac{3}{2}$ yd.

941. An agent sells flour on commission of 2%, and purchases goods on true commission of 3%. If he had received 3% for selling and 2% for buying, his whole commission would have been \$5 more. Find the value of goods bought. *Id.*

By W. J. HUSSEY, Ohio, Ill.

Let 100% = value of flour. Then, in the first case, 2% = commission for selling, and 98% = proceeds. The proceeds (98%) = investment (100%) + commission on investment (3%). Whence 3% on investment = $\frac{2.94}{103}\%$ of value of flour. Adding the two commissions, we have $2\% + \frac{2.94}{103}\% = \frac{5.98}{103}\%$ = total commission in first case. In like manner $\frac{5.98}{103}\%$ = total commission in the second case. And by the conditions of the problem $\frac{5.98}{103}\% - \frac{5.98}{103}\% = 5.00$, whence 100% = \$10506, value of flour.

By W. C. BINKLEY, Cincinnati, Ohio.

Let 100% = flour and 98% = proceeds, and $98 \div 103 = 95\frac{15}{103}\%$ = goods. Commission on goods is $98 - 95\frac{15}{103} = 2\frac{88}{103}\%$; $2\% + 2\frac{88}{103}\% = 4\frac{88}{103}\%$, his whole commission. But if he had received 3% on the flour, the proceeds would have been 97%; $97 \div 102 = 95\frac{5}{51}$ = goods. $97 - 95\frac{5}{51} = 1\frac{46}{51}\%$, commission on goods; $3 + 1\frac{46}{51} = 4\frac{46}{51}\%$, what his whole commission would have been. Hence $4\frac{46}{51}\% - 4\frac{88}{103}\% = \frac{250}{553}\%$ = \$5; and 100%, or the flour, = $5 \div \frac{250}{553} = \10506 .

942. A guardian was to pay to his wards \$31,000, with interest at 6% per annum, in five equal biennial installments. He loaned the money at 6% compound interest and paid off the installments as they came due; how much did he make by the transaction? What would have been the biennial installments, if he had loaned the money for the wards alone? *C. W. THOMPSON.*

By A. L. FOOTE, Merrick, N. Y.

Let P = the amount in guardian's hands, r = the rate per cent. Then we have

$P(1+2r)^5 - [(1+2r)^4 + (1+2r)^3 + (1+2r)^2 + (1+2r) + 1]x = 0$, or
 $x = P(1+2r)^5 \div [(1+2r)^4 + (1+2r)^3 + (1+2r)^2 + (1+2r) + 1] = \8599.7
 the amount of the biennial payment. Again, if it had been loaned at compound interest for the wards alone, we should have

$$P(1+r)^{10} - [(1+r)^8 + (1+r)^6 + (1+r)^4 + (1+r)^2 + 1]x = 0,$$

from which we find $x = \$8676.5278$, the amount of payment if the money had been loaned for the benefit of the wards.

Now, for the amount made by the guardian, we have

$$P(1+r)^{10} - [(1+r)^5 + (1+r)^6 + (1+r)^4 + (1+r)^3 + 1] \times 8599.70169 \\ = \$491.567.$$

Problems for Solution.

959. By cutting off a strip 3 inches wide around the outer part of a square board, I found $\frac{1}{3}$ of it remained; what was the area of the board?

D. W. K. MARTIN.

960. A 5% ten-year bond sells at par when the interest is payable every six months; what ought it to sell for when the interest is payable quarterly?

L. B. FRAKER.

961. How many inch balls can be placed in a box, 10 inches square and 5 inches deep, inside measure?

LIMA.

962. Exchange the following notes for five others of equal value and due at equal intervals: \$920 due in 30 days, \$840 due in 35 days, \$1000 due in 75 days and \$1200 due in 95 days.

Id.

963. From a point in an equilateral triangle, the distances to the vertices are 20, 28 and 31 rods. Find side of triangle and its area.

F. H. GOUDY.

964. What is the amount of \$1, at 5% interest, compounded *continually* for one year?

WM. WILEY.

965. The line bisecting the right-angle of a triangle is 20 feet, and the hypotenuse 60 feet. Find the base and perpendicular.

J. W. JONES.

966. A line 20 inches long is divided in extreme and mean ratio. Find the length of segments.

J. C. CORBIN.

967. What must be the altitude of the least cone circumscribed about a sphere 6 inches in diameter?

ROBT. J. TOTTEN.

968. Three witnesses, A, B and C, testify in favor of an event. All that is known concerning the veracity of these witnesses is, that B's statements are twice as reliable as A's, and C's three times as reliable as A's. What is the probability that the event occurred?

ARTEMAS MARTIN.

969. The cube of a certain number increased by 14 times the same number is 624. Find it.

J. W. PFEIFFER.

970. The probability that A can solve Prob. 106, p. 408, *Ray's Higher Arithmetic*, is $\frac{3}{4}$; the probability that B can solve it is $\frac{5}{12}$. If both try, what are the probabilities, (1) that both solve it; (2) that A solves it and B fails; (3) that A fails and B solves it; (4) that both fail?

B. F. FINKEL.

971. Two right circular cylinders intersect at right angles to each other. Required the volume of the solid common to both, if they are each 2 inches in diameter.

WAYLAND DOWLING.

972.

A wealthy man two daughters had
And both were very fair;
To each he gave a tract of land,
One round, the other square.
At twenty shillings an acre just,
Each piece its value had;
The shillings that did compass each
For it exactly paid.
If 'cross a shilling be an inch,
Which had the greater fortune,
She that had the round or square?

GEO. A. STINE.

973. A, B and C can do a piece of work in $3\frac{1}{2}$ days. A can do it in 5 days less than B, but B can do it in 10 days less than C. In what time can each do it alone?

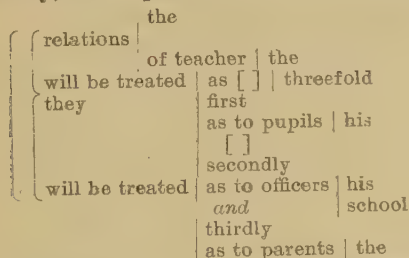
F. H. GOUDY.

Solutions on or before Jan. 1, 1887. Credits will be given next month.

ENGLISH GRAMMAR.

Answers to Queries.

1. Please diagram—"The relations of the teacher will be treated as threefold: first, to his pupils, secondly, to his school officers, and thirdly, to the parents.



As in first member is considered a preposition, governing *relations* understood. As may be taken as an introductory conjunction, and *relations* understood in the predicate with *will be treated*.

2. Can there be a common gender?

SUBSCRIBER.

Ans.—Yes, sir. Gender, as a property of the noun, is merely a grammatical distinction of words of words with regard to natural distinction of sex, and does not refer directly to living things. Hence it is proper to apply common gender to words which are *common* to both genders; that is, to words which are used either in the masculine or feminine gender, or both. For example, He, she and I recited *our* lesson. Here *our* is of the common gender. Also, George Eliot's *Romola* is excellent, in which *George Eliot's* is parsed in the feminine gender, though *George Eliot's* is a name applied to persons of the masculine gender. Also, My name is *John*, in which *John* is in the neuter gender.

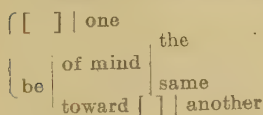
3. Are the following sentences correct?

Id.

(1) "His unusual unexpected and extraordinary success surprised him." (2) "I have a contemptible opinion of him."

Ans.—Insert a comma after *unusual* in (1). Both are then grammatically correct.

4. Diagram—Be of the same mind one toward another.



NOTE.—This department will be enlarged and somewhat changed next year so as to embrace studies in English and American literature and observations on the origin, structure and peculiarities of our vernacular tongue. It will be the department of *Literature and Language*, and all interested are invited to contribute short and unique articles and notes together with queries pertaining to the special subjects. This alone will be worth a year's subscription to the magazine. It will commence with January.

EXAMINATION QUESTIONS.

USED AT GREENVILLE, OHIO, NOV. 6.

ARITHMETIC.

1. What per cent. is made by buying berries by dry measure and selling at the same price per quart wine measure?

Ans.—The gain is $(268.8 - 231) \times 100 \div 231 = 16\frac{4}{11}\%$.

2. Gold is quoted $113\frac{1}{2}$; what is a United States bank-note worth in gold?

Ans.—With gold as the basis, the bank-note is worth $100 \div 113\frac{1}{2} = 88\frac{24}{25}$.

3. There is a certain island 18 miles in circuit, which A and B undertake to travel round, both starting from the same point and going round in the same direction. When A has traveled 17 miles and B 7 miles, how far apart are they?

Ans.—Measuring along the circumference they are apart $(18 - 17) \div 7 = 8$ mi.

4. When it is 11 A. M. at a place 30° east of Greenwich, it is 3 hr. 44 min. 20 sec. A. M. at Buffalo; what is the longitude of Buffalo?

Ans.—Difference of time is 7 hr. 15 min. 40 sec. and difference of longitude, $(7 \text{ hr. } 15 \text{ min. } 40 \text{ sec.}) \times 15 = 108^\circ 55'$; hence the required longitude is $108^\circ 55' - 30^\circ = 78^\circ 55'$.

5. If I sell hay at $\$1\frac{3}{4}$ per cwt., what should I give for $9\frac{3}{4}$ tons, that I may make $\$7$ on my bargain?

Ans.—I should realize $(\$1\frac{3}{4} \times 20 \times 9\frac{3}{4}) \div \$7 = 348.25$.

6. Given one of the diagonals of a field, in the form of a trapezium, equal 17 chains, 56 links, to compute the area, the perpendiculars to that diagonal from the opposite angles being 8 chains. 82 links, and 7 chains, 73 links.

Ans.—Let $ABCD$ be the trapezium, $AD = 17.56$ chains, $BF = 8.82$ chains and $CE = 7.73$ chains; then the area of triangle ABD is $17.56 \times 8.82 \div 2 = 77.4396$ sq. ch.; area of the triangle $ACD = 17.56 \times 7.73 \div 2 = 67.8694$; and area of trapezium is $77.4396 + 67.8694 = 145.300$ sq. ch., or 14 A. and 84.896 sq. rd.



7. A circular field is 360 rods in circumference; what is the diagonal of a square field that shall contain the same area?

Ans.—Since the area of a circle may be found by squaring *half* the circumference and dividing by $\frac{355}{113} = 3.14159$, we have $180^2 \div \frac{355}{113} = 206.15$ sq. rd. Since the area of a square may be found by squaring the diagonal and dividing by 2, we reverse this rule and find $\sqrt{(206.15 \times 2)} = 20.3$ rd. for the required distance.

8. What is the volume of a cylinder, whose length is 9 feet, and the circumference of whose base is 6 feet?

Ans.—The area of base is $3^2 \div \frac{355}{113} = 2.865$ sq. ft., and the solidity of cylinder is $2.865 \times 9 = 25.78$ cu. ft.

9. A hired a house for one year for $\$300$; at the end of 4 months he takes in B as a partner, at the end of 8 months he takes in C. At the end of the year, what rent must each pay?

ANS.—The rent for the first four months is $\frac{1}{2}$ of \$300 = \$100, which A pays; for the next four months it is \$100, of which A pays \$50 and B \$50; the last \$100 is paid equally by A, B and C, or \$33 $\frac{1}{3}$ each. Hence A pays in all \$183.34, B, \$83.33, and C, \$33.33.

10. Required, the area of a sector, of which the arc is 90° , and the radius of the circle 25 feet.

ANS.—The area of the circle of which the sector is one-fourth part, is $25^2 \times \pi = 625\pi$; area of sector is $625\pi \div 4 = 156\frac{1}{4}\pi = 490.87$ sq. ft.

GEOGRAPHY.

1. Name the grand divisions crossed by the Equator, the Arctic Circle, and the Tropic of Capricorn.

ANS.—See map.

2. What forms the boundary line between France and Spain; Europe and Asia; South Carolina and Georgia; Tennessee and North Carolina; Louisiana and Texas?

ANS.—(a) Pyrenees Mts. (b) Ural Mts. and river. (c) Savannah, Tugalo and Chatooga rivers (d) Stone, Yellow, Iron, Bald and Smoky Mts. (e) Middle of Sabine Lake and Sabine River to the point where this river is intersected by the parallel of 32° ; thence due north to the Red River.

3. Describe the largest continental river in the world.

ANS.—Volga River. See p. 12 for full description.

4. Distinguish between a delta and an estuary, and give an example of each.

ANS.—In full, p. 11.

5. Distinguish between an absolute and a limited monarchy, and give an example of each.

ANS.—See p. 199 for a clear distinction.

6. Describe the earth as to its size, motions and position in the solar system.

ANS.—Diameter at equator 7925 mi.; and polar diameter 7899 mi. Density 5.6 times that of water. Weight in round numbers 6,000,000,000,000,000,000 tons. Diurnal and annual revolutions and for the *third* motion see p. 181 and p. 70, Vol. 6. It is the third planet from the sun.

7. Under what circumstances would there have been no change of seasons? and under what circumstances would this change have still been greater?

ANS.—No change of seasons if the earth's axis were perpendicular to the ecliptic; the greater the inclination of axis the greater the change in seasons.

8. Name six cities that are capitals of states in the region of the parallel of 40° north latitude.

ANS.—See map.

9. Describe the most important water-way in the United States.

ANS.—The Mississippi River with its branches forms the most important water-way. It rises in Lake Glazier about three miles above Lake Itasca. The stream connecting these lakes is about 2 feet deep and about 12 feet wide.

10. Of what does the United States consist? The Cordilleras?

ANS.—It consists of 38 states, ten territories and the federal District of Columbia. The Cordilleras consist of a number of ranges; the Rocky, Sierra Nevada, Coast Range and Cascade are the principal ones.

GRAMMAR.

1. Name the classes and the properties of nouns.

Ans.—Common and proper. Gender, person, number and case.

2. What is the conjugation of a verb? The synopsis of a verb?

Ans.—The regular arrangement of its properties. The conjugation in one person and number.

3. Illustrate the use of
- what*
- in four different parts of speech.

Ans.—He may parse *what* (noun). I see *what* (rel. pro.) it is. *What* (adj.) books do you use? *What!* (inter.) Did you say I failed?

4. Correct, if necessary: I knew it was him. I seen him when he done it. They have saw him frequently.

Ans.—Say *was he, saw him, did it*, and omit *have in last*.

5. Classify the following verbs with respect to forin: Go, live, saw, see, write, walk, sleep, promote, arrive, exemplify.

Ans.—Live, saw, walk, promote, arrive and exemplify are regular; others, irregular.

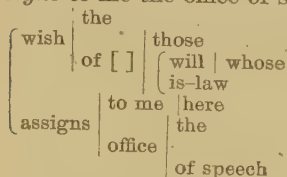
6. Indicate the pronunciation of anemone, advertisement, St. Augustine, hymeneal, bouquet, aluminous.

Ans.—See dictionary.

7. Write a sentence containing a verb in the passive voice, potential mode, present perfect tense, second person, plural number and modified by an element of the second class.

Ans.—You may have been criticised by William.

8. Analyze or diagram: The wish of
- those whose*
- will is law
- here*
- . assigns to me the office of speech.



9. Parse italicized words in the above.

Ans.—*Those* is an adjective, modifying the noun understood. *Whose* is a relative pronoun, possessing *will*. *Here* is an adverb, modifying *is*. *Assigns* is a verb, and agrees with its subject *wish* in person and number.

10. Scan the following lines and name the author:

The heights by great men attained and kept,
Were not attained by sudden flight.

Ans.—Iambic tetrameter. Longfellow.

SPELLING.

Monologue, insurable, glacier, tranquillity, synonymous, licorice, belles-lettres, callous, chalice, rouge, champagne, principle, gneiss, metallize, Connecticut, geysers, Hayti, Labrador, Lyons, Panama.

HISTORY.

1. Give a short history of the District of Columbia, and describe its government.

Ans.—Dec. 23, 1788, Maryland offered to cede to the U. S. any district not over ten miles square, and afterwards added a grant of \$72,000. Dec. 3, 1789, Virginia offered a similar cession, and followed by a grant of \$120,000. These offers were accepted by Congress. Thos. Johnson and Daniel Carroll, of Md., and David Stuart, of Va., were appointed commissioners to survey and establish the lines. Ellicott was the surveyor. April 15, 1791, the initial corner stone of the lines was planted at Jones's Point with Masonic solemnities. The public archives were removed from Philadelphia to the new seat in 1800, and Congress met soon after (Nov. 21). May 3, 1802, the city of Washington was incorporated. Sept. 18, 1793, the foundation stone of the north wing of the capitol was laid by Washington, and the building was finally completed in 1827. Slavery was abolished April 16, 1862, and Jan. 8, 1867, colored men were admitted to vote in the district; territorial government was established by Congress in 1871, a provisional government in 1874, which was finally superseded in 1878 by the permanent government. This is administered by three commissioners, appointed by the President. There is no local legislative body, Congress exercising exclusive legislation.

2. When and where did the Second Continental Congress meet and what was the action of that body?

Ans.—At Philadelphia May 10, 1775, and voted to raise 20,000 men. A petition to the king was ordered to be prepared. The formation of a federal union was inaugurated, and steps taken to organize an army and navy.

3. What is known as Lee's Famous Resolution?

Ans.—“*Resolved*, That these united colonies are, and of right ought to be, free and independent states; that they are absolved from all allegiance to the British crown; and that all political connection between them and the state of Great Britain is, and ought to be, totally dissolved. That it is expedient forthwith to take the most effectual measures for forming foreign alliances. That a plan of confederation be prepared and transmitted to the respective colonies for their consideration and approbation.” Seconded by John Adams.

4. Describe and locate what is known as the Western Reserve.

Ans.—It is sometimes called *New Connecticut*, situated in the northeast quarter of Ohio, between L. Erie on north, Pa. on the east, parallel of 41° on the south, and Sandusky and Seneca counties on the west. It is 120 miles long and from 50 to 68 miles wide, containing 3,800,000 acres. Connecticut came in possession of it by charter of King Charles II., of England, in 1662.

5. What was the Ostend Manifesto? During whose administration?

Ans.—A manifesto published by a conference of American ministers, including Buchanan, Mason and Soule, who met at Ostend, Belgium, in 1854. It recommended the annexation of Cuba to the U. S. England and France found Spain opposing the plan, and the project was dropped.

6. Sketch the Presidential canvas and election of 1876.

Ans.—There were five political parties in the canvas. The *Greenback* party came before the country and assembled in convention at Indianapolis May 17, nominating Peter Cooper, of N. Y., and Samuel F. Carey, of Ohio, for President and Vice President. It embraced the wage-labor interest, anti-monopoly, opposition to specie redemption, etc. The *Prohibition* party met on the same day and nominated Green Clay Smith, of Ky., and G. T. Stewart, of Ohio. It demanded the prohibition of the liquor traffic in D. C. and the territories, and

amendments to the constitution to make the restriction universal. The *National Christian Association* whose platform went against all secret societies and in favor of prohibition, met at Pittsburgh, June 9, and placed James B. Walker, of Ill., and Donald Kirk Patrick, of N. Y., on their ticket. The *Republican* convention met at Cincinnati and nominated R. B. Hayes, of Ohio, and Wm. A. Wheeler, of N. Y. The *Democrats* met at St. Louis June 27. They demanded reform in the administration, a return to specie payments, a modification of tariff and a discrimination against Chinese immigration. Samuel J. Tilden, of N. Y., and Thos. A. Hendricks, of Ind., were the nominees. The election of Nov. 7, 1876, hinged on the validity of the La. and Fla. elections. The republicans claimed that fraud and violence had been used to secure democratic majority, while the democrats denied the charge and claimed the returns had been legally made and Congress had no power to exclude them, if the election had been a fair one. Popular vote stood 4,033,950 Republican 4,284,885, Democratic, Greenback 81,740 and Prohibition 9,552. La. and Fla. were transferred from democratic to the republican side, March 1, by the Electoral Commission, which consisted of fifteen men whose names and organization are given on p. 196, Vol. 4. This gave Hayes and Wheeler 185 votes against 184 for Tilden and Hendricks. The former were inaugurated March 5, 1877.

7. State five important events of Grant's second administration.

ANS.—(1) Trouble with the Modoc Indians in Oregon, over their removal to a reservation. (2) The money panic attending the failure of Jay Cooke & Co., bankers at Philadelphia. (3) Louisiana Embroglio, the culmination of a party strife between the two rival governors, Kellogg and McEnery. (4) Centennial Exhibition at Philadelphia. (5) Electoral Commission.

8. Describe the Mecklenburg Resolutions.

ANS.—In May, 1775, after constant irritation attending the extortion practiced by the officers of the crown in some of the interior counties, the Scotch-Irish settlers about Charlotte, Mecklenburg Co., N. C., met in convention, and the spirit of the times found expression in those famous resolutions in which "all laws and commissions by authority of king and parliament" were declared to be annulled and vacated, and a new government was organized for the county, recognizing only the authority of the provincial congress. This was the prelude to the Declaration of Independence, for N. C. was the first of the colonies to instruct its delegates to the continental congress to vote for formal independence of the British crown.

9. Describe the difference between the government of a territory and that of a state.

ANS.—A state has a subordinate but regularly constituted government, a constitution through which exclusive powers are exercised not delegated to it by the U. S. constitution. A territory has no such powers, and is governed by officers amenable to the general government.

10. For what are the following persons noted: Jefferson, Henry, Garfield, Franklin and Grant?

ANS.—See pp. 22, 85 and 134.

NOTE.—The Shawanoese called the Ohio river, *Kis, ke, pi, la, Sepe*, that is, Eagle river. The Wyandots were in the country generations before the Shawanoese, and their name of the river should stand in preference to all others. *Ohio* may be called an improvement of *O, he, zuh*, and was no doubt adopted by the early French voyagers in their boat songs, and is substantially the same word as used by the Wyandots, the meaning applied by the French, fair and beautiful (*La belle riviere*), being the same as that meant by the Indians—great, grand and fair to look upon.—*Historical Collections*.

MISCELLANEOUS DEPARTMENT.

Answers to Queries.

1028. Who is known by the famous name, as "Herd Laddie"? Give a short sketch of his life.

Ans.—Mr. James Wyllie, champion draughts player of the world, is known by this name. He was born in Edinburgh, Scotland, in 1822. Mr. Hedley, Mr. Wyllie's friend and biographer, tells how he came by this name, in the following words: "He was apprenticed to a master in Kilmarnock to learn the trade of Brussels weaver, but this business proving too sedentary for his constitution, he abandoned it for the nomadic and freer life of a peddler, and with a stock of hardware travelled through the surrounding villages disposing of his goods and displaying his skill and wonderful knowledge of the draught board whenever an opportunity was afforded him. At Biggar he formed the acquaintance of Mr. Porteous, a cattle dealer and an ardent and enthusiastic draughts player, who, delighted with the youth's ability at the game, conceived the design of taking him to Edinburgh to give the players of that city a pleasant surprise. Wyllie's consent to this project was readily obtained, and in company with Mr. Porteous and in the assumed capacity of that gentleman's "Herd Laddie." In England, in America, in Australia, or wherever the game of draughts is practiced, that name is familiar. Mr. Wyllie must have commenced draught playing at a very early age, for we find him playing for the championship against the celebrated Anderson in 1838. Mr. Wyllie made two visits to this country; the first in Oct., 1873, returning in Sept., 1876. In 1881 he returned to America and travelled on the American Continent for two years visiting Kansas City, St. Louis, Chicago, Washington, Philadelphia, New York and other cities and towns. He played Barker, a brother of the present champion of America, 50 games and won. Out of 20,000 games he won 18,000 and lost 109, the rest being drawn.

JOHN YOUNG.

1068. What were the "Thirteen Fires"?

B. S. D.

Ans.—The thirteen original states were so called by the Indians.

S. B. KECKLER.

1069. Who invented the miner's Safety Lamp?

KATY DID.

Ans.—Sir Humphrey Davy, the greatest chemist the world has known, was born in Cornwall, England, 1778. At an early age he began the study of Natural Philosophy, and this incited him into a study of Chemistry, which he began in 1797. He soon became the assistant of Dr. Beddoes, founder of a Pneumatic Institution at Clifton. He nearly lost his life on several occasions during this engagement, while making experiments on the respiration of different gases. Davy was Lecturer of the Royal Institution of London from 1800 to 1812, when he resigned his position. In 1815 he began an investigation of the nature of fire-damp, which led to the invention of the safety-lamp. His health began to fail in 1825 and he died at Geneva, 1829. The honor of inventing the safety-lamp is also claimed for Stephenson.

W. S. CAMPBELL.

The miner's safety lamp was invented by Sir Humphrey Davy in 1815. It consists of three upright rods of brass or iron, fixed below into a brass plate, with a screw margin. Within the three upright brass rods is fitted a gauze cylinder, with a flat top, firmly attached to the brass plate at the bottom; the whole is then screwed on the top of a round lamp, with its usual opening for the wick. A small spout, projecting from the side, supplies the reservoir with oil, and a bent wire passing through the bottom of the lamp serves to raise, and in a measure trim the wick, so that when once lighted, before being screwed to the gauze frame, the lamp need not be opened while in the mine.

After many experiments, Sir Humphrey discovered that, however inflammable the gas might be, it ceased to be explosive when obliged to pass through narrow tubes. That is, if he had a vessel full of carburetted hydrogen, or fire-damp, and inserted in the side of that vessel a number of cut quills, and applied a light to their ends, the gas coming through them would be hardly inflammable at all; and further, he discovered that the smaller he made the diameter of the tubes, the shorter might be the length of the tubes themselves; this led him to conceive that wire gauze, made extremely fine, would entirely prevent the inflammability of the gas.

S. B. KECKLER.

1070. What two governments are bound together by "steel ties"?

Ans.—The United States of America and Mexico. The Mexican Central R. R. binds the territories of the two governments together in the sense that the rails are continuous. The road is 1225 miles in length, and extends from El Paso to the City of Mexico. It was completed in March, 1884.

FRANK LESLIE.

1071. To what depth does light penetrate in clear water? What causes the changes in the color of the sea?

S. A.

Ans.—By use of photographic plates known as *emulsion* plates, it has been found that light penetrates water at least 300 feet. Many theories have been propounded to explain the phenomena of color, but it is conceded generally that blue is the color proper of water. The best theory, we believe, is that the blueness is produced by the absorption of light.

EDITOR.

1072. Give termini of all the Atlantic Cables.

Id.

Ans.—Between Heart's Content, N. F., and Valentia, Ireland, 3; Canzo and Penzance, 2; Brest and Duxbury, Mass., and Cape Cod, 2; and Torbay and Ballyskillys, 1, making eight in all. The last completed was in 1879.

W. W. WOODS.

1073. Why are *ae* combined in such words as *pean*, and how would you designate such combinations in oral spelling?

AMPHIC.

Ans.—Because the old form is retained in such words. The word given is now written *pean*, also. We do not designate this combination in oral spelling except for precision, when we say *monogram ae*. In writing *ae* or *æ* a curve is placed over the two letters.

EDITOR.

1074. What enables the chameleon to change its color?

A. L.

Ans.—It is true that the chameleon changes its colors with great rapidity, but the changes are not determined by the colors of surrounding objects, nor by the greater or less amount of blood sent to the skin. It has been ascertained by experiments that the varieties of color in the squid are due especially to changes in the surface of the skin from the voluntary contractions of the muscular fibers in the dermis, modifying the reflections from the pigment spots as well as from the colorless portions of the skin. It is probable considering the scaly character of the skin, that similar surface reflections, from contraction of the muscular fibers of the dermis, are the causes of the changes of color in the chameleon; and that the inflation of the lungs and body, and the changes in the cutaneous circulation are merely secondary agents.

WILL DAVIDSON.

1075. What is the connecting link between mind and matter? Explain fully.

Id.

Ans.—We think the connecting link is the nervous fluid or animal electricity. Mind has inherent motion and living power, and there can be no manifestation of power except through motion. Hence mind is the first moving cause. The mind wills, and this mental energy gives an impulse to the nervous force,

which is electricity. This causes the nerve to vibrate or to act upon the muscle. The muscle contracts and moves the bone, and the bone enables us to move matter. To explain this wonderful subject fully would require all the pages of this magazine. Consult some special work on "Electrical Psychology."

EDITOR.

1076. Cats kill field mice, field mice destroy the nests of bumble-bees, and the bumble-bees assist in fertilizing clover. Now, what relation does the cat sustain to the farmer in this respect? W.W.W.

Ans.—Cats as well as dogs are often more detrimental than useful, and are kept by people as pets.

GALEN.

1077. What caused the panic on East-River suspension bridge, six days after it was opened for passage, in which twelve persons were killed and many wounded?

Id.

Ans.—At 3 P. M., on Decoration Day, 1883, when the footwalk was thronged with visitors, the cry of a woman who had fallen on the steps was heard at the west stairway. The crowding populace pushed forward to see what was the matter. Those in front were locked and packed between the railing, and carried forward by the weight of the surging crowd, they crushed one another. Thirteen were killed and many wounded.

EDITOR.

1078. Give a list of twelve novels which you think are the best and noblest available to English readers.

READER.

Ans.—A literary club in Chicago a few years ago addressed letters to its friends for a list of *best novels*. Seventy answers were received and 147 novels recommended. The twelve novels having the highest number of votes are: Hawthorne's *Scarlet Letter*, Hugo's *Les Misérables* (each 39 votes), George Eliot's *Romola* and *Adam Bede* (37), Scott's *Ivanhoe* (35), Dickens's *David Copperfield* (28), Thackeray's *Henry Esmond*, Goethe's *Wilhelm Meister*, Mrs. Stowe's *Uncle Tom's Cabin* (each 24), —————'s *On the Heights* (German author, whose name we can not now give, 23), Brontë's *Jane Eyre* and Dickens's *Tale of Two Cities* (each 20). For the full vote and letters, send 10 cents to Chas. H. Kerr & Co., 175 Dearborn St., Chicago, for *Ten Great Novels*, Unity Leaflet No. 9, and tell them you saw this in the *Ohio School Visitor*.

EDITOR.

1079. Give a brief sketch of the Rev. Wm. R. Alger.

Id.

Ans.—William Rounseville Alger, is an American clergyman and author, cousin of Horatio Alger, jr. He was born at Freetown, Mass., in 1823. He graduated at Harvard College in 1847, studied for the ministry, and became pastor of a Unitarian church in Roxbury. In 1855 he removed to Boston, where he succeeded Theodore Parker as minister of the "Liberal Christians" who worship in Music Hall, that city. His works comprise "The Poetry of the Orient, or Metrical Specimens of the Thought, Sentiment, and Fancy of the East"; "A Critical History of the Doctrine of a Future Life"; "The Genius of Solitude, or the Loneliness of Human Life"; and "Friendships of Women."

WILL DAVIDSON.

1080. When and how was the roller milling process introduced into this country?

MILLER.

Ans.—This process had its origin in Switzerland about 1820. Two mills were brought to America by Oscar Oexle, a milling engineer in 1873, and the first successful roller milling in this country was in one end of the Washburn C mill at Minneapolis in 1878.—*Americana*.

EDITOR.

1081. Who were—"The Orphic sage," "The American Rousseau," "The Scotch Archimedes," "The English Rabelais," and "The prose Homer of human nature"?

L. B.

ANS.—Amos Bronson Alcott (1799–1882), who wrote “Orphic Sayings” for the *Dial* (1840–44), father of the fluent and forcible writer, Louisa May Alcott, is the “Orphic Sage.” He died in the house where Thoreau lived and died in Massachusetts.

Henry David Thoreau (1817–1862), who never went to church, never voted, and never paid tax to the state, was a land-surveyor and a bachelor, and is known as the “Rousseau of America.”

Jas. Watt (1736–1819), a Scottish engineer, philosopher and inventor of great merit and celebrity, was called the “Scotch Archimedes.”

Dean Swift may be termed the “English Rabelais.” Hallam in his *Introduction to the Literature of Europe*, says: “The *Tale of the Tub* is, in my apprehension, the master-piece of Swift; certainly Rabelais has nothing superior, even in invention, nor anything so condensed, so pointed, so full of real meaning, of biting satire, of felicitous analogy.”

Henry Fielding (1707–1754), a celebrated English novelist, answers for the last. His greatest work is *Tom Jones* which appeared in 1749. He wrote *Jos. Andrews* and *Amelia*.

1082. What is the difference between *problem* and *example* as used in Arithmetic?

J. S. H.

ANS.—A *problem* is a question with given data involving an unknown or undetermined result, which is to be found by a process called a solution. An *example* is either a question solved or unsolved, illustrative of some previously announced principles or rule.

A. L. FOOTE.

1083. What is the difference between a Revolution and a Rebellion, and what are the four points upon which a Revolution is based? *Id.*

ANS.—A revolution contemplates an entire change in a government, while a rebellion is simply a resistance to, or war against, the constituted authorities.

1084. Who was the author of the Missouri Compromise? *Id.*

ANS.—Jesse B. Thomas, of Ill., was the author of the Missouri Compromise Bill.

NOAH A. WARE.

Henry Clay was a strong supporter of this measure, and through his wonderful persuasive powers, the “Compromise” was made.

EDITOR.

1086. Will the editor discuss the disputed question as to the date of Ohio’s admission into the Union? *Id.*

ANS.—There is a disparity of opinion lately as to the date of Ohio’s admission into the Union. We gave our views on page 214, Vol. 6, *School Visitor*, and we still prefer to recognize Nov. 29, 1802, as Ohio’s birthday and its virtual admission. We always taught this date, and never saw it disputed till of later years when historians and authors are becoming more numerous, eager to bring forward something new. Howe in his *Historical Collections of Ohio*, says: “On the 30th of April, 1802, Congress passed an act authorizing the call of a convention to form a State constitution. This convention assembled at Chillicothe, Nov. 1, and, on the 29th of the same month, a constitution of State government was ratified and signed by the members of the convention. It was never referred to the people for their approbation, but became the fundamental law of the State by the act of the convention alone; and, by this act, Ohio became one of the States of the Federal Union.”

This is one of the earliest and best histories of Ohio. Sherman & Smith’s *Gazetteer of the United States*, (an excellent old work), states: “In 1802, Ohio formed her constitution and was admitted into the Union.” The U. S. Census reports have always given this date, even the *Compendium of Census tables of 1880*, lately issued, gives Nov. 29, 1802. The constitution adopted by the convention empowered, and directly required, the Territorial officers to discharge the duties of office until their successors were duly qualified.

Some think that the act of Congress passed Feb. 19, 1803, "to provide for the due execution of the U. S. laws in the *state of Ohio*," should be considered the date of admission, as it was an expression approving our constitution. This view is held by Atwater in his *History of Ohio*, Mansfield's *Political Economy* and Paschal's *Annotated Constitution*. In the Secretary of State's report for 1879, Pres. Andrews, late of Marietta College, advocates strongly the same view.

Others prefer to date the event March 3, 1803, when Congress assented to the changes made by the Convention in reference to school lands, which the enabling Act of April 30, 1802, suggested. Since there seems to be an unsettled date among various authors who place the event in 1803, we think it is best to keep the old, reliable day (Nov. 29, 1802.) as the most desirable, for the special reason that the United States always has recognized this date in its official reports. Ohio had likewise considered this date as its birthday into the Union, as shown in all its early histories. They certainly knew what they were doing at the time, and it is unfortunate for students of history that such a change of dates was made. The *Visitor* shall adhere to the date first established, until it may be found that March 3, 1803, is the time when the compact was completed, and the state duly admitted.

EDITOR.

1087. Describe the battle of Hastings and assign a cause for Harold's failure. P. E. H.

Ans.—Harold the Second was the successor of Edward the Confessor, who was a cousin of William, Duke of Normandy. It has been supposed by some that Edward had made a verbal promise to the duke with reference to the succession of the throne. But be this as it may, the duke sent ambassadors to Harold, demanding of him a resignation of the crown, and charging Harold with the violation of his oath not to assume the sovereignty of the kingdom. The duke's ambassadors were sent back with a peremptory refusal, stating that the oath had been extorted from him and consequently was null and void, and that he would defend his right against all opposition. This led to one of the most noted battles in English history.

The Battle of Hastings was fought Oct. 17, 1066. It was waged with great fury and equal bravery on both sides; at first the English were thrown into temporary disorder by the long bows of the Normans, not being used to that species of warfare; but soon recovered themselves and attacked the enemy with redoubled fury, compelling them to fall back. But they also rallied and in their turn renewed their onset upon the English. The English had an advantage over the Normans in the use of their *bills*, a species of hooked battle axe. It was in vain on the part of the Normans to attempt to break the ranks of the English army; it stood like a solid wall against their most furious assaults. The duke, however, fell upon a stratagem that had the desired effect. This was to make a feint of retreat, by allowing his men to fall back in order, fighting as they did so. The English in the eagerness of the pursuit broke their ranks, and thus the Normans were enabled to make fearful slaughter while in this state of disorder. Harold, however, again rallied his forces and attacked the Normans, killing great numbers of them. The battle had commenced at seven in the morning, and it was now near night and no seemingly decided result gained on either side. The duke concluded to make one more desperate onset against the English before night should close in upon the two armies. In this encounter Harold was shot by an arrow, which entering the brain, proved fatal, upon which the English, completely dismayed, fled and left the victory in the hands of the Duke of Normandy.

Cause of Harold's failure: 1st, Harold, in the battle of Stamford bridge against his brother Toston and Harfagar the king of Norway, had lost very heavily, and his army was still further weakened by desertion in consequence of dissatisfaction at Harold for taking to himself all the spoils in that battle. 2d, It is also probable that the English, owing to their previous night's carousal, were not in as good fighting condition as the Normans. A. L. Foote.

1088. Explain fully the Earth's refrigeration.

A. L. M.

Ans. There must have been a time in the history of the Universe, when every particle that now composes it, was scattered in infinite space. By the Omnipotent command of God, every particle began to move toward a common center, thus constituting the universal law of gravitation, which is a law guided by the hand of God.

The concussion of the particles produced heat sufficiently to ignite the whole mass into an intensely heated globe, perhaps a thousand or more times hotter than our sun. According to the Nebular Theory, our earth constituted a portion of this mass.

From the time it was arrested from the main mass, it has constantly been radiating heat. Winchell says, "We trace the footsteps of this progress at every age. Through Azoic, Eozoic, Paleozoic, Mesozoic, and Cenozoic Ages, heat has been gradually wasted in space—the solid crust has been thickening—the surface conditions have been changing. The average temperature of to-day, instead of being a state that is destined to perpetuity, is but a passing phase; and when we shall have passed away with other transient existences around us, some succeeding intelligence, gifted with the power to travel from sphere to sphere, will note the world in altered condition." See Winchell's *Sketches of Creation*.

B. F. FINKEL.

1089. Why is the sky blue?

S. S.

Ans.—The azure tint of the cloudless sky is due to the decomposition and refraction of light, as it passes through layers of air successively increasing in density. The blue and violet, being more refrangible than other colors of the solar spectrum, are diffused through the atmosphere; and, being reflected from its particles, they impart to it their own color.

WILL DAVIDSON.

1090. To what diseases is the *Germ Theory* applied?

Id.

Ans.—This theory is now widely adopted and views all epidemic diseases as due to parasites, which gain entrance to the body through the medium of water, air, food, or otherwise, and which increase enormously, exhausting the strength and injuring the patient. The inflammation of wounds, blood-poisoning, scarlatina, measles, diphtheria, typhoid, yellow, relapsing and malarial fevers, leprosy, small-pox, tuberculosis, cholera, and a number of other diseases, are due to this comma bacillus. Rabies or the "mad dog" disease, epizootic among horses, are also due to this unknown bacterium. The indefatigable Koch of Germany and Pasteur of France, have made great discoveries in this direction. Koch detected in the tubercle of consumption a characteristic bacterium, and by inoculation with this he produced the disease in rabbits and guinea-pigs. See *Encyclopedia Americana*.

EDITOR.

List of Contributors to this Number.

S. B. KECKLER, *Weaver's, Ohio*, 1074, 10084, 1088, 1090.

W. W. WOODS, *Bloomertown, Ohio*, 1069, 1072, 1082, 1084, 1085, 1087, 1089.

A. L. FOOTE, *Merrick, N. Y.*, 1069, 1089.

NOAH A. WARE, *West Manchester, Ohio*, 1069, 1074, 1089.

ANNA KLEY, *Versailles, Ohio*, 1069, 1082, 1084, 1085, 1087.

H. W. HOLYCROSS, *North Lewisburgh, Ohio*, 1069, 1074, 1084.

ORVAL HYER, *Gettysburgh, Ohio*, 1084, 1085.

W. S. CAMPBELL, *El Dorado, Ohio*, 1084.

J. L. REPP, *Ansonia, Ohio*, 1069.

QUERISTS.—FRANK LESLIE, *Columbia City, Ind.*; I. J. WIREBACK, *St. Petersburg, Pa.*; J. L. REPP, *Ansonia, O.*; L. S. HOWELL, *New Madison, O.*; JOHN YOUNG, *Packerton, Pa.*; WILL DAVIDSON, *Lewisburgh, O.*; S. GRANT OLIPHANT, *New Field, N. J.*; C. STUBBS, *Gettysburgh, Ohio*; F. H. GOUDY, *Lainys, Ohio*.

--- QUERIES. ---

1114. What caused the Indians near Jamestown Colony to plant powder to grow ammunition? FRANK LESLIE.
1115. Give the rhythmical enumeration of the English kings, beginning, "First William, the Norman," etc. I. J. WIREBACK.
1116. Give all the poets-laureate of England. Id.
1117. Describe fully the circumstances and surroundings under which the *Star-spangled Banner* was written. J. L. REPP.
1118. Who was the first to tread upon *Forefather's Rock*? The first mother and bride in New England? Id.
1119. What Vice President took the oath of office in Cuba? L. S. HOWELL.
1120. Do humming birds fly backwards? JOHN YOUNG.
1121. What is the origin of tarring and feathering? Is any mention made in history of the practice? CURIOUS.
1122. Australia is said to be the "Land of Inverted Orders," and South America the "Continent of Threes". Why? WILL DAVIDSON.
1123. Why are the people of Nebraska called "Bug Eaters"? S. GRANT OLIPHANT.
1124. What is the story of Soter, the dog of Corinth? When did the event occur? Id.
1125. What is meant by the "Tapestry of Queen Matilda"? C. STUBBS.
1126. Describe the "Field of the Cloth of Gold." NOAH WARE.
1127. When was the first 3-cent piece coined in the U. S.? H. W. HOLYCROSS.
1128. Explain the ellipticity of the earth's orbit, position of the sun, etc. W. S. CAMPBELL.
1129. Name and locate an inverted volcano. F. H. GOUDY.
1130. Where is the "land of mud"? Id.
1131. The water of what river can be detected 300 miles at sea? Id.
1132. What statesman first advocated *states' rights*? Id.

NOTE.—We wish to call your attention to the complete index found on the following pages. Most of the subjects pertain to matter presented in this department during the year 1886. By the assistance of able contributors, we propose to publish some of the rarest and best information obtainable in history, biography, science, and wonderful facts, during the coming year, and everybody will be benefited by it. We thank our friends most heartily for the interest taken in this direction, and all are invited to contribute the best things which you find. About a dozen of the 1400 queries which have been published, are unanswered. This speaks well for the scholarship and research of its contributors. References to authorities should be given by contributors, if convenient. Answers to above queries should be received on or before Jan. 1.

Index to Volume VII.

- | | | | | |
|-------------------------------|--------------------|----------------------|----------------------|------------------------------------|
| Author of | Bacon's rebellion, | 13 | Christmas abolished, | 21 |
| A little more grape, | 69 | Badajoz, healthy | 21 | Chronometer, |
| And still they come, | 23 | Ballot-box, first, | 116 | Cincinnati, order of |
| <i>Andrews & Amelia</i> , | 272 | Bancroft, Geo. 12-8, | 179 | Cinnatus of West |
| <i>Barnes's Histories</i> , | 112 | Banks, | 59, 118 | Cinnamon, |
| Bible, germ of musk, | 207 | Bartlett, Dr. S. P. | 130 | Circle of illumination, |
| Blood is thicker, | 142 | Battles, | 21, 134-40, 203 | on maps, |
| Breathes there the, | 228 | Bees, queen | 204 | Cities, largest |
| <i>Curfew Must Not</i> , | 92 | Belknap, Wm. | 231 | Civil War, |
| Give me a place to, | 159 | Bills, become laws | 106 | Clay, |
| I will find a way or, | 180 | Binkley, W. C. | 128 | Cleveland, Parker |
| Laugh where we, | 93 | Biographies, | 128 | Rose |
| Mark that man for, | 226 | Bismarck, Gen. | 177 | Cabinet |
| Millions for defence, | 18 | Black Hole, | 115 | Cliff dwellers, |
| <i>Orphic Sayings</i> , | 272 | Blair bill, | 247 | Climate, |
| Spare the soldiers, | 112 | Blennerhassett, | 40 | Cloves, |
| Sweet bird, thy bow'r | 93 | Bloody Bridge, | 224 | Coal, |
| <i>Tale of a Tub</i> , and | | Blount, Wm. | 230 | Coasts and climate, |
| <i>Tom Jones</i> , | 272 | Bonaparte, | 68 | Coffee, |
| Wisdom and justice, | 158 | Bonham, | 114 | Coinage, U. S. |
| Acid, muriatic | 70 | Boodle, | 228 | Coke, how made, |
| Æ, œ, | 270 | Bore in Para R. | 47 | Colleges, oldest |
| Æpyornis, extinct | 23 | Bowie, James | 114 | Colonies, original 13, |
| Agnosticism, | 225 | Boycott, | 143, 154 | Comet. Lexell's, |
| Air, suddenly cooled, | 159 | Bragg, Baxton, | 69 | Comin' thro' the rye, |
| Alabama claims, | 134 | Brains, size of | 70 | Congress, |
| Alamo, fort | 113 | Bratton, Mrs. | 182 | Conrad III., |
| Alaska, | 39, 139 | Bridgman, Laura | 118 | Constitution, 13, 60, 106-15 |
| Alcott, A. B. | 272 | Bridge-building Bro. | 159 | Continents, |
| Alfalfa, | 249 | Brower, Geo. G. | 128 | Convention. Hartford |
| Alphonso XIII., | 254 | Brown, S. J. | 128 | Copernicus, |
| Alfred the Great, | 139 | John | 84 | Corbin, J. C. |
| Alfred's Jewel, | 21 | Buckram, | 252 | Cork, |
| Alger, Wm. R. | 271 | Burgesses, House of | 18 | Corsica, |
| Alien laws, | 93 | Burlingame embassy, | 13 | Council of Constance |
| Allen, Wm. | 23 | Burns, Robert | 142 | County, round |
| Alum, where found, | 23 | Burr, Aaron | 40 | Credit Mobilier, |
| Americanist, | 228 | Buttons, | 251 | Crockett, David |
| Ames, Oakes | 108 | Byron of her sex, | 67 | Croll, Dr. |
| Amrita cup, | 231 | Cackling of geese, | 91 | Crompton, |
| Ana, meaning of | 179 | Calculations, | 253 | Crops, statistics, |
| Angleland, | 194 | Calico, | 252 | Cutting, A. K. |
| Anglo-Saxon, | 223 | Calvert's vessels, | 155 | <i>Curfew Must Not Ring</i> |
| Archimedes, | 159, 272 | Cambric, | 252 | Custer's last fight, |
| Arkwright, | 171 | Canal, Erie | 116 | Dalrymple, John |
| Army of Occupation, | 91 | Capitals, | 13, 39, 142 | Damask, |
| Arnold's last words, | 141 | Carlisle, Thos. | 138 | Darke Co., |
| Artillery, 1st used, | 140 | Carson, Kit | 113 | Darrah, Lydia |
| Astrolabe, | 158 | Caspian Sea, | 109 | Darwin's theory, |
| Asteroids, | 20 | Catholics, | 140 | Dates, such as 173 $\frac{2}{3}$, |
| Atlanta, burning of | 141 | Chameleon, colors of | 270 | important, |
| Atlantic, the ship | 94 | Champe, John | 84 | Date-line, |
| cables, 107-16, | 270 | Charles VII., | 66 | Davidson, Albert |
| Attoo island, | 183 | Chase, Samuel | 231 | Davenport, John |
| Australia, | 38 | Chicago, | 254 | Davy, Sir Humphrey |
| Authors, | 271-2 | Chicken-hearted, | 224 | Days, |
| Axis of earth, | 265 | Chili, | 217 | names of |

Days, notable dark	230	Florida	173	Hoe, Richard	205
why 24 hr.	45	Foreign mission	22	Holland, surface of	173
Death valley	92	Fountain, silver	19	Homer, the prose	272
of noted men	138	Franklin	85	Hooker, Gen.	172
DeAyllon	250	Frustum	180	Hoover, William	175
Debts of U. S.	68	Gallatin, Albert	22	House of Wisdom	46
Declaration	23	Garfield memorial	22	Houston, Sam	84
Delaine	252	last words	69	House-tax insur.	159
Delegates, convention	141	shot where	92	Hovas	86
Deltas	11	Garrison, surrender	66	Howe	118, 171
Deseret, state of	114	Gaspee, burning	245	Huguenots	245
De Soto, full account	107	Garments, warm	115	Hull, Gen.	172
Dial, figures on	93	Gath, who is	206	Humphreys, West	231
Discoveries	41, 246	Geiger, Emily	182	Hunt, Mrs.	247
Disease, germ theory	274	Generals	21, 84, 134	Hurry, the ringer	91
District of Columbia	267	Geneva tribunal	39	Hutchinson, Anne	69
Diveys, how they work	70	Genet, citizen	85	Ice lake	38
Doctor's Mob	177, 224	Genoa	63	Iceland	66
Douglas, Stephen A.	105	Genseric, King	65	Impeachments	231
Dred-Scott decision	172	Geography	11, 109, 244	Indians	85, 181, 245
Drowned men rise	69	Germany	199	Industrial schools	225
Duel, the Burr	85	Giant, the Little	105	Jackson	39, 117
Dustan, Hannah	229	Gibraltar	63	Japan Islands	217
Abbott	227	Glacial period	226	Jefferson	39, 41, 85
Dyaks, the	86	Glencoe valley	156	Jemen or Yemen	231
Eagle, emblems	18	Glucose, how made	177	Jesuit fathers	84
Doctors of France	21	God, name of	179	Johnson, Col. John	181
Earth, facts	35, 91, 108,	Gold discovered	113	Richard M.	204
180, 225, 244, 265, 274		Golden-footed dame	17	Andrew	231
Earthquakes	17	Goodyear	171	Johnston, Jos. E.	172
Ecliptic	37	Gough, last words of	118	Judas of the West	17
Edgar, Edred, etc.	227	Governments	41, 62, 244	Jupiter, its seasons	116
Edgerton	116	Grangers	13	Keckler, S. B.	128
Education	95	Grant	85, 134	Kilpatrick	172
Edward IV.	112	Great Britain	38	King, Wm. R.	23
Egg, largest	23	Powers	63	starved	66
Elbe, chain navigati'n	112	Schism	67	of fashion	67
Electa, history of	229	Greely expedition	119	effigy	91
Electors of 1880	116	Greenville	64	as spy	139
Elevations, noted	86, 118	Gulf Stream	44	six boys	237
Elements, English	194	Gunder, Henry	131, 168	Krakatau	178
Ellwood, J. K.	129	Gunpowder Plot	140	Lac, described	251
Emancipation	134	Gutenberg, John	156	Lady Rebecca	39
Emblems of Europe	244	Hair-buying General	117	Lakes	66, 86
English Language	194	Hair reproduced	69	Land of Health	21
Ericsson	172, 40	Hamilton	46, 85, 117	midnight sun	47
Eubank's rules	153	Hansford hanged	13	No Man's	230
Euxine sea	90	Hannibal	269	Land's End	12
Evans, Marian C.	17	Harrison	19, 157, 254	Language	195, 219
Events, important	268	Hargreaves, Jas.	181	Le Petit Corporal	68
Expounder consti'tion	39	Hartwick, Rosa	92	Lascarbault	253
Explorers	106	Hastings, Battle	195, 273	Lasker Incident	177
Fabrics, names of	252	Hemisphere, water	86	Last words	141, 159
Fahlberg, Dr.	177	Henry, Patrick	85	Latinisms	195
Field, Cyrus W.	22, 172	II., of England	91	Leadville	118
Fielding, Henry	272	Herd Laddie	269	League of the Hague	117
Fish, the angler	249	Hessians	59	Lee, J. D.	114
Fitz, meaning of	90	Hildreth, Richard	13	Lee's resolutions	157, 267
Fitz-John Porter	94, 154	History	58, 59	Lesseps	94
Flag, names of	22	Historians	12, 20	Levater, John C.	206

Lewis & Clarke	84, 245	Morse, Prof.	171	Pitcher, Mollie	182
Liberia	86	Mosquito Reserve	253	Pitman, Isaac	115
Liberty-bell ringer	22, 91	Mother Goose	255	Planets	37
Light thro' water	270	Motte, Mrs.	182	Plateaus, noted	199
Lincoln killed	39	Motley, John L.	13	Platforms, party	229
Lincoln's ring, Mrs.	159	Mts., highest	11, 294	Plumb line prolonged	207
Livingstone, Robt.	23	Music in school	254	Plymouth colony	202
Locations	12	Muslin	252	Pocahontas	39, 204
Logan, poet	93	Mythology, Hindu	231	Pocket veto	117
Lord's prayer, A. S.	223	Navigation, chain	112	Pond, D. S.	128
Lossing, Benson	13	Navy yards	117	Population, density of	37
Louis XI. of France	18	Nepal	253	Postal cards, origin	92
Lover's leap,	139	Newton, Isaac	142	P. O. of two letters	206
Lucern,	249	Nile, valley of	12	Pouring oil on waters	92
Lyons, Gen.	224	Norton, Caroline	67	Prestwich, John	157
MacDonald tribe	156	North, Chas.	67	Prescott, Wm. R.	12
McCrea, Jane	182	Nose, toper's	116	Presidents 17, 39, 84, 118,	159, 178, 245, 254
McNeil, Mrs.	182	Novels, best	270	Presidential canvas	267
McPherson, Gen.	172	Ohio	203, 244, 268	succession	95
Mad Anthony,	39	admitted	272	President's graves	46
Maid of Orleans,	66	Gong	23	nicknames	46
Sarogassa	66	Old Hickory	39	Prince of Wales	92
Mist	115	Old Point Comfort	155	Printing	156, 205
Maiden town	225	Ordinance of 1787	106	Proviso, Jefferson's	94
Malden, British	117	Organs of speech	198	Proctor, Gen.	117
Maoris	86	Orphic Sage	272	Psychology	270
Mars, satellites of	183	Ostend Manifesto	267	Quintessence	178
Marshall, James	113	Pacific, why calm	226	Railroad riots	13
Massacre, Mt. Mead.	114	Pan Handle	155, 230	underground	155
Ft. Alamo	113	Panic, E. River	271	oldest in O.	250
Glencoe	113	Para River bore	47	Rabelais, English	272
Masonic Relic	113	Parsons, A. F.	129	Races in U. S.	37
Mather, Cotton	172	Parliament of Paris	205	Rainless regions	47, 132
Matter, composition	204	Participle	219	Raleigh, Sir Walter	142
Mecklenburg Res.	58, 268	Patterson, Thos.	247	Rasures, Francis	218
Memorial window	22	Patroons	245	Rebellion,	59, 272
Men carry log	204	Peacock throne	157	Dorr's	59
eminent	59, 183	Peck, Jas. H.	231	Shay's	84
Meridians, astronom.	207	Pen, Blair-bill	247	Reign of Terror	19
Mesmerism,	206	Penny, value of	118	Relief, forms of	11
Meteors, formation of	158	Pendulum,	91	Republics	109
Mexico, late troubles	218	Peninsulas	38	Revolution	105-6, 272
Michigan	173	Perry's victory	58	Rhode Island	14, 69
Mills, Jas. S.	95	Personal liberty laws	112	Rivers	12, 37, 244
Mill-boy of slashes	39	Persia, throne of	157	Roggeveld	224
Mines of Hispaniola	250	Perkins, Eli	206	Roller process	271
Ministers, foreign	65	Pestalozzi's laws	180	Rome	20, 71, 91
Mind, the	105, 270	Pet banks	117	Ross, Mrs.	202
Mints, U. S.	179	Pfeiffer, J. W.	128	Rousseau, American	272
Mo. Compromise	172, 272	Pharon, the lover	139	Rulers of Europe	18, 254
Miss. River, source	265	Phonetic reform	195	Saccharine	177
Mode, defined	219	Phonography	115	Sacred vessels	65
Monitor & Merrimac	40	Physiognomy	206	Safety lamp	269
Monroe doctrine,	59	Piazzi, Prof.	20	Sage of Kinderhook	39
Monsoons	63	Pickering, John	231	Monticello	39
Monarchies	199	Pico dos Orgaos	224	Salt, spilling	19
Moon's distance	37	Pierre d'Ailly	21	deposits	23, 90
circular edge	253	Pilgrims' names	40, 206	Sandwich Islands	38
Morris, Gouverneur	115	Pindar, Peter	206	Sappho, poetess	139
Robt.	254	Piqua Indians	181		

St. Clair's defeat	134	States	39, 59	Velvet	252
St. Helena	63	State ex. list	193, 220	Vesuvius, Mt.	63
Savilian professor	84	Steamers	94, 115	Veto, President's	203
Saxons	194	Steel ties bet. gov'ts	270	Vice President	
Schism, great	68	Stenhouse, Fanny	252	elected by senate	39
Schmitt, Cooper D.	129	Steppes	109	tried for treason	108
Schmucker, S. M.	225	Storms	157	Victoria Falls	228
Scott, Walter	142, 228	Stone of Scone	178	Volga River	12
Sea, movements	217	Swift, Dean	272	Voter, 1st colored	247
Seal, U. S.	157	Swim, fat man	44	Voting qualifications	23
Confederate	180	Sword	181, 247	for Pres., 1856,	68
Seasons,	37, 217	Syntax	219	owner of slaves	93
Secession leaders	252	Tally-ho	17	in Congress	204
Siege of Ninety-Six	155	Talleyrand	206	N. Y. not	157
Senators	22, 245	Taney, Roger	172	Vulcan, planet	253
Settlements, first	106	Tangkuban	224	Wallis, Dr.	21, 44
Sevastopol, siege of	252	Tatnall, Capt.	142	Walloons	245
Seven hilled city and		Taylor, J. M.	130	War, Aroostook	227
mortal sins		Zachary	69	Civil	152
virtues		Tea, where found	173	of 1812	171
bodies alchemy	71	Tecumseh	204	French & Indian	105
Shackelford, Col.	203	Telegraph on train	226	of meal sacks	70
Shades of death	67	Telegraphic plateau	116	of Roses	253
Shall and will	196	Temperance S.	141, 154	Thirty years	21
Shawl, origin of	252	Territory, governed	268	Second Punie	180
Showing white feather	71	Teufelsdröckh	206	Warren, Mercy	229
Signs in Algebra	249	Thirteen Fires	269	Washington's oath	22
Signal service	119, 218	Thompson, C. W.	129	farewell address	45
Silk worm	205	Thurman, Allen G.	90	Watt, James	272
Sir, title	142	Tides, in Fundy Bay	70	Waterloo	63
Six nations	90	Time, nat. divisions	150	Water boils, altitude	116
Sky, why blue	274	Toscanelli	250	under pressure	
Slate, where found	254	Travis, Wm. B.	114	kept from freezing	250
Slavery	152	Treaty, X. Y. Z.	18	Wayne's Treaties	248
Sleeping position	204	Webster-Ashburton	59	Waves	243
Slick, Sam	206	Clayton-Bulwer	94	Weather bureau	218
S. M. S., author	225	with China	115	Webster, Daniel	115
Smoke	228	tri-partite	155	Weddings ever held in	
Snow-line	86	Wayne's treaty	248	White House	176
Society, anti-slavery	65	of Hidalgo	246	Weinsberg spared	68
Sofyan, Abu	70	of Ghent	246	West Virginia	58
Soil, how formed	38	Tree of life	21	Wheatley, Phillis	229
Soldiers' Homes	207, 224	Trissius Gemma	19	Whisky Rebellion	203
Solstices	109	Tropics	37	Whitney, Eli	105, 172
Sons of Liberty	58	Triple alliance	155	White Rock	181
Sovereignty, squatter	105	Truce of God	92	Whittier, J. G.	172
Spiders, flying	249	Tubal-cain	181	Will and shall, uses of	196
Spinning Jenny	181	Tyler, John	58	Williams, Roger	69
Sponges	251	United States	12, 86	William and Mary	156
Spring, wonderful	17	true area	150	Winds	12
Squares, digital	248	boundaries	154, 245	Wise men	205
Ss., meaning of	17	crops, etc.	199	Women save city	68
Sugar, product	173	debts	172	Woodworm	249
Sumbing	224	exports, imports	132	Wyandots	268
Sun, fast or slow	17	mints	179	Wyllie, James	269
vertical rays	157	seal	157	Yale College	85
Sunlight	252	purchases	106, 244	Zane, Betty	182
Stanton, Edwin	172	University, German	67	Zone of Calms	108
Stars and Stripes	202	Van Buren	39	mathematical	109
Stark, Mollie	183	Vanderbilt	172	climatic	109

INDEX TO MATHEMATICS.

Air, vol. by pressure	147	Furrows, length of	54	Problems	9, 32, 55, 81, 103,
expansion	239	Game playing	210	127, 169, 191, 215, 240, 262	
Algebraic equation	186	Globe of glass	25	Pumps, strokes	6
Alligation problem	234	Gold and silver	209	Quadrant, bisect	235
Arith. ex. questions	10, 35,	Grindstone	77	Quadrilateral, bisect	239
56, 82, 104, 133, 149, 193,		Hemisphere, pressure	54	Quincunx order	97, 122
216, 241, 264		ice in	165	Rate of duty	3
Balance, cheat with	53	Hole in wet board	100	off for cash	51
Ball, shared	79	Horse and barn	4	Rectangle, boys round	98
Balls in box	77	Husking, 2 men	101	oil can	210
Bascom's whisky	101	If $\frac{1}{3}$ of 6 be 3,	233	Ring, anchor	51
Belt on pulley	146	Interest, guardian	261	Signals by flags	121
Bernoulli's formula	73	Ladder to top poles	187	Specific gravity	187
Board, divide tapering	76	sliding on wall	50	Sphere and cube	28
Bonds, income	10, 29	two inclined	28	Spheroid, frustum of	99
Books on shelf	5	Latitude from star	4	Square and circle	28
Bridge, curve of	6	Letters delivered	209	find side	237
Chance problem	148	Loaves shared	54	area	100
Circle, segment of	121	Log tapering	186	stakes on	122
flagstaff round	78	Longitude	234	a nine	126
travel round	52	Loss & gain	10, 27, 53-4,	Stock, invest in	7, 26, 27
7 inscribed	166	187, 210		Stream, 10-foot pole	125
Circular excavation	235	Months having r .	26	Stumps and stones	212
Cirtern of plank	4	Mowing, 2 men	75	Time past noon	11
Clock, hands irreg.	5	Needle, diff. direction	122	Trapezoid	164, 236
Cloth shrinking	212	Notes, various kinds	10	Travelers	36, 123, 214
Commission	261, 211, 78	discounted	11, 147	Trees on plane	124
Cone, frustum of	185	Numbers, square	31	Triangle	30-1-3
Conical loaf, divide	8	Papering walls	147	find side	99, 124
vessel, ball in	8, 30	Pendulum, length	99	construct	100, 145
Cubes in box	74	Permutations	239	divide	98
building	4	Pi, algebraic determi.	167	medians	238
Cylindrical vessel	211	Pillar, shape of	100, 145	3 men carry	236
Discount	11	Planets in conjunc.	124	Tucks in muslin	27
Door, hinge pressure	29	Pole breaking	237	Victor riding	163, 189
Egg buying	162	Population, increase	161	Volume generated	97
Fathers and sons	162	Pressure, door hinges	29	Weighing deer	186
Figures on paper	75	Guericke's Hem.	54	Wheat running	214
Fly on spoke	164	Pumpstock and well	49	Working, two men	52


 FINIS
 



